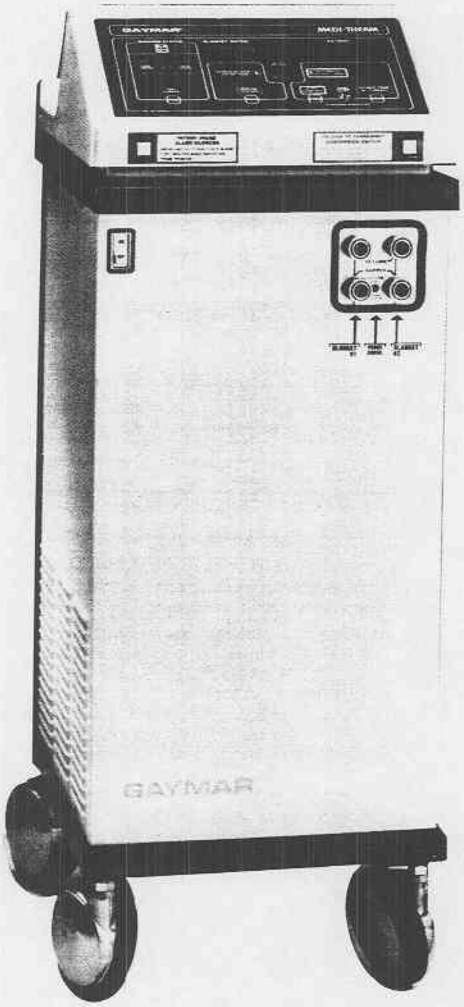
GAYMAR®

MEDI-THERM Hyper/Hypothermia

SERVICE MANUAL

AUTOMATIC/MANUAL CONTROL
MODELS MTA-4700/MTA-4701/MTA-4702


GAYMAR
MEDI-THERM
GAYMAR

(UL) LISTED 303L

STANDARD (NORME)
C22.2 NO. 125 RISK
CLASS (CATEGORIE
DE RISQUES) NO. 2G

P/N 06686-000

PLEASE NOTE

IMMEDIATELY UPON RECEIVING YOUR MEDI-THERM, BEFORE PROCEEDING IN READING THIS MANUAL, PLEASE REFER TO THE RECEIVING INSPECTION PROCEDURES IN SECTION 3.1 ON PAGE 3-1.

Objective

This publication is intended to provide the reader with significant data regarding the essential characteristics of equipment incorporated in the Gaymar Medi-therm. Although every attempt has been made to present information which is both complete and current, the large number of variations both in the equipment itself and in its application make it impossible to cover all of the contingencies which might arise in its installation, operation, or maintenance. In addition, incorporation of design changes to improve performance or reliability may occur at any time and are not necessarily reflected in the information provided. The right to revise or change this publication in whole or in part without prior notice is reserved. Should further information be desired or should problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to **Technical Service–Gaymar Industries, Inc.**

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REUSABLE CONTAINER RC-1
USAGE INSTRUCTIONS

1. With unit in upright position rotate latches to unfasten container sections.
2. Using handles provided lift upper container section off base section.
3. Remove accessories.
4. Lift unit out of base section.
5. If transformer is included, remove transformer from base section and follow transformer usage instructions.
6. Follow start-up instructions in Operating Instruction Manual.
7. To repack, reverse unpacking instructions. See inside diagram for positioning of components.
8. To clean reusable container, wipe with cloth wetted with water/soap solution.

TRANSFORMER MODEL XFM-1
USAGE INSTRUCTIONS

Note: This unit is for use with Gaymar Medi-Therm model MTA-4700 only.

1. Place XMF-1 unit onto shoulder bolts provided on rear of MTA-4700 unit.
2. Make certain that the circuit breaker, on-off switch of MTA-4700 and XFM-1 units are in the off position.
3. Plug power cord of XMF-1 into 220V, 50/60 HZ outlet.
4. Plug power cord of MTA-4700 unit into receptacle on side of XFM-1.
5. Turn circuit breaker of XMF-1 to on position.
6. Follow start-up instructions for MTA-4700 unit.

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1.0 GENERAL INFORMATION

1.1 PRECAUTIONS

1.1.1 PATIENT-RELATED PRECAUTIONS

1.1.1.1 PATIENT SAFETY

Maximum benefit to the patient at the greatest margin of safety requires a thorough knowledge and understanding of the correct operation and application of the unit. **THE OPERATOR MUST UNDERSTAND THE OPERATING MANUAL AND ALL PRECAUTIONS PRIOR TO USE. PRECAUTIONS SHOULD BE CAREFULLY REVIEWED. CHECK THE PATIENT AND BLANKET WATER TEMPERATURE EVERY 20 MINUTES OR AS OFTEN AS DIRECTED BY THE PHYSICIAN.**

CAUTION: **POWER INTERRUPTION WILL CAUSE UNIT TO GO INTO STANDBY MODE (NO THERAPY) AND REQUIRE RESETTING BY THE USER BEFORE THERAPY CAN BE CONTINUED.**

1.1.1.2 BLANKET TEMPERATURE EFFECTS

BLANKET TEMPERATURE SHOULD BE SET ONLY AS PRESCRIBED BY AND UNDER THE GUIDANCE OF A PHYSICIAN. CHECK PATIENT, INCLUDING PATIENT'S CORE TEMPERATURE, SKIN CONDITION IN AN AREA IN CONTACT WITH THE BLANKET AND THE BLANKET WATER TEMPERATURE EVERY 20 MINUTES OR AS OFTEN AS DIRECTED BY THE PHYSICIAN. CHECK PEDIATRIC, TEMPERATURE SENSITIVE, AND OPERATING ROOM PATIENTS MORE FREQUENTLY.

A. **Operating Room Patients** - Patients with poor circulation associated with inadequate heart function, reduction in blood volume, and constriction of peripheral blood vessels may deviate from the normal response to the external application of heat and cold.

B. **Temperature Sensitive Patients** - Patients with impaired peripheral blood circulation caused by vascular diseases and patients who are incapacitated may be more sensitive to temperature changes than patients with more normal circulation. Patients unable to detect temperature (i.e. spinal chord injury) should always be closely monitored when a temperature blanket is in use.

C. Pediatrics - The core temperature in infants and children is more responsive to surface heating and cooling than in adults. The smaller the patient the more pronounced the effect because of their higher ratio of skin contact area to body volume.

D. Additional Heat Sources - Heat being applied by the blanket could result in a rise in skin temperature in the area of contact. Additional heat rise due, for example, to electrosurgical currents flowing to the dispersive electrode, could be sufficient to cause tissue injury. Each thermal effect by itself may be completely safe; however, the additive effect may be injurious.[1*] **DO NOT PLACE ADDITIONAL HEAT SOURCES BETWEEN THE PATIENT AND THE BLANKET.**

E. Localized Skin Injury - Localized skin injury corresponding to tissue compressed between boney prominences and fluid-filled channels has been associated with prolonged cardiovascular procedures and blanket temperatures well below the scientifically established epidermal burn injury threshold.[2,3,4,5,6]

Local ischemia can follow the application of pressures exceeding mean capillary pressure, resulting in tissue necrosis. This local effect may be enhanced by generalized impairment of the circulation, local shearing forces, and increased metabolic demand because of temperature elevation. Pathological changes may begin in two hours.[7] **PREVENT EXCESSIVE AND/OR PROLONGED TISSUE PRESSURE AND SHEARING FORCES–ESPECIALLY OVER BONEY PROMINENCES.**

1.1.1.3 PATIENT CORE TEMPERATURE

If the patient's core temperature is not responding and/or does not reach the prescribed temperature in the prescribed time and/or deviates from the prescribed temperature range, the attending physician should be notified. **MONITOR THE PATIENT'S CORE TEMPERATURE FREQUENTLY.**

*** Numbered superscripts refer to references in Section 1.1.1.6 of this manual.**

1.1.1.4 BLANKET COVERING

A dry cotton sheet placed between the patient and the blanket provides a sanitary barrier and absorbs perspiration. A sheet also promotes a more even distribution of heat and contributes to the reduction of localized tissue pressure. **PLACE A DRY, COTTON SHEET BETWEEN THE PATIENT AND THE PLASTIC BLANKET SURFACE. GAYMAR'S MUL-T-BLANKET® ALSO PROVIDES A FABRIC SURFACE FOR WHICH AN INTERPOSED SHEET IS NOT REQUIRED.**

1.1.1.5 DRYNESS BETWEEN THE PATIENT AND BLANKET

The application of heating or cooling may affect the toxicity of solutions. Prep solutions have been reported to injure the skin when allowed to remain between patients and a water-circulating heating blanket during prolonged procedures.[8,9] **KEEP THE AREA BETWEEN THE PATIENT AND THE BLANKET DRY.**

1.1.1.6 LIST OF REFERENCES

1. Electrosurgery, AMM 310 (6/76), Ritter Co., Rochester, NY.
2. Scott, Stewart M. Thermal Blanket Injury in the Operating Room. Arch. Surg. Vol. 94, p. 181, Feb. 1978.
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5. Moritz, A.R. and Henriques, Jr., F.C. Studies of Thermal Injury II. The Relative Importance of Time and Surface Temperature in the Causation of Cutaneous Burns. Am. J. Path., 23:695, 1947.
6. Stoll, Alice M. and Chianta, Maria A. Method and Rating System for Evaluation of Thermal Protection. Aerospace Medicine, Vol.40, No. 11, pp. 1232-1238, Nov. 1969.
7. Kosiak, Michael. Etiology of Decubitus Ulcers, Archives of Physical Medicine and Rehabilitation, p. 19, Jan. 1961.
8. Llorens, Alfred S. Reaction to providone-iodine surgical scrub associated with radical pelvic operations. Am. J. Obstet. Gynecol., pp. 834-835, Nov. 14, 1972.

9. Hodgkinson, Darryl J., Irons, George B. and Williams, Tiffany J. **Chemical Burns and Skin Preparation Solutions.** Surgery, Gynecology & Obstetrics, Vol., 17, pp. 534-536, Oct. 1978.

1.1.2 CONTROL UNIT-RELATED PRECAUTIONS

A. **IMPORTANT - ALWAYS PERFORM FUNCTIONAL CHECK-OUT AND SAFETY INSPECTION AFTER MAKING REPAIRS AND BEFORE RETURNING MEDI-THERM FOR PATIENT USE. IMPROPER REPAIR COULD RESULT IN PATIENT INJURY.**

B. Do not run the machine without water, as damage to internal components may result. Use distilled water only. Alcohol should not be added to the water.

C. Gaymar Medi-Therm machines are provided with a means of checking rectal/esophageal temperature probes. When performing the probe check, use a disposable probe sheath (B-D catalog #3700 thermometer sheath or equivalent) to prevent cross contamination.

D. Use YSI 400 Series patient probes or equivalent.

1.2 REPAIR POLICY

The Medi-Therm Hyper/Hypothermia Unit is warranted free of defects in material and workmanship for a period of one (1) year. The compressor portion of the unit has an additional four (4) year pro-rated warranty. The Medi-Therm Hyper/Hypothermia Units can be repaired at the factory or in the field. Upon customer request, a shipping carton will be provided to safely return the unit to Gaymar or a qualified Service Center.

For customers who elect to repair Gaymar Medi-Therm Units at their location, this manual contains information to allow a qualified bio-medical technician, familiar with practices for servicing medical devices, to make necessary repairs. Service training for the Hyper/Hypothermia Unit is recommended and is available from Gaymar. For specific details, contact your Gaymar representative.

1.2.1 IN-WARRANTY REPAIRS

All in-warranty field repairs must be authorized by Gaymar's Technical Service Department before proceeding.

A. Replacement lamps will be furnished at no charge during the warranty period. Since average lamp life is 14,000 hours, lamp failure is an uncommon occurrence.

B. Unit calibration is considered part of preventive maintenance procedures and is not covered by Gaymar's Warranty.

1.2.2 OUT-OF WARRANTY REPAIRS

The following repair options are available when local unit servicing is elected:

A. **Defective Component** - Replacement parts can be ordered. Specify the Gaymar part number; reference Parts List in Section 4 of this manual.

B. **Defective Printed Circuit (PC) Board** - Defective PC boards can be exchanged for refurbished boards at a fixed cost directly from the factory.

C. **Defective Top Module** - The defective top module can be returned (without base) to the factory or qualified Service Center for repair.

D. **Unit Repairs** - If a Hyper/Hypothermia Unit becomes defective and the cause of the problem cannot be determined, the complete unit can be returned to the factory for servicing. This normally represents the most expensive repair option.

1.3 SPECIFICATIONS

1.3.1 PHYSICAL SPECIFICATIONS

A. **Dimensions:** 37 inches high x 17-1/8 inches deep x 14 inches wide (93.98 cm. high x 43.50 cm. deep x 35.56 cm. wide)

B. **Weight - MTA-4700/4701:**

145 lbs. (full); 124 lbs. (empty); Shipping Wt.: 150 lbs. 65.77 kg (full); 56.25 kg (empty); Shipping Wt.: 68.04 kg.

Weight - MTA-4702:

155 lbs. (full); 134 lbs. (empty); Shipping Wt.: 160 lbs.
70.31 kg. (full); 60.78 kg. (empty); Shipping Wt.: 72.58 kg.

C. Reservoir Capacity: 9 quarts (8.52 liters) distilled water.

D. Pressure, Dead Head: 7.0 ± 1.0 psi (48.23 ± 6.89 kPa).

E. Flow: 16 GPH (60.57 liters/hour) minimum through a full size **GAYMAR H/H Blanket.**

1.3.2 THERMAL SPECIFICATIONS

A. High Temperature Limits

1. Adjustable:	41°C ± 0.5°C	(Average Water Temperature)
2. Fixed:	43°C to 46.5°C	(Unit will go into **MACHINE SHUT-DOWN FROM SERVICE** condition and Audible Alarm will be on.))
	47°C to 50°C	(Will turn heater off and on only.)

B. Low Temperature Limits

1. Adjustable:	Cut in 5.2° - 6.5°C Cut out 3.9° - 4.5°C
2. Fixed:	2.5°C to - 3.0°C

C. Flow Switch Actuation Level

12 ± 2 GPH (45.42 ± 7.6 liters)

D. Check Probe Activation Temperature (Whenever probe is used.)

Below 25°C or above 45°C

E. Patient Temperature Control Range for Automatic Mode

25°C to 41°C

F. Blanket Water Temperature Control Range for Manual Mode

4°C to 41°C

G. Warm-up Rate Curve

See Figure 6.1, Page 6-1

H. Cool Down Rate Curve

See Figure 6.2, Page 6-1

1.3.3 ELECTRICAL SPECIFICATIONS

A.	Display Accuracy:	Water Temperature	± 1 °C, ± 1.8°F
		Patient Temperature	± 0.5°C, ± .9°F
B.	Controller Accuracy:	Water Temperature	± .75°C, ±1.3°F
		Patient Temperature	± 0.5°C, ± .9°F

		MTA-4700	MTA-4701	MTA-4702
C.	Current Leakage: Chassis Microamps Maximum	100	100	200
	Patient Probe (Grounded) Microamps Maximum	50	50	100
D.	Input Voltage (Volts)	120 ± 10	100 (±10) (- 5)	220 ± 20
E.	Frequency (Hz)	50/60	50/60	50/60
F.	Power Consumption (**WATTS**)	1325	1150	1188
G.	Input Current (**AMPS**)			
	--with compressor and heater **ON**	11.5	10.0	5.5
	--with compressor **ON**	7.5	6.5	3.0
	--with heater **ON**	4.0	3.5	2.5

1.3.4 PROBE SPECIFICATIONS

A. Disposable Probes

1. DP-400 - Disposable Rectal/Esophageal--Adult/Small Child - 3' length (requires adaptor).
2. ADP-10 - Reusable adaptor cable for DP-400 (connects to Gaymar or Cincinnati Sub-Zero equipment).
3. ADP-10B - Reusable adaptor cable for DP-400 (connects to American Medical Systems equipment). **NOTE: THIS ADAPTOR CONTAINS TWO ADDITIONAL RESISTORS TO PROVIDE TEMPERATURE OFFSET FOR USE WITH AMERICAN MEDICAL SYSTEMS EQUIPMENT ONLY. SEE ADAPTOR CIRCUIT DIAGRAM, FIGURE 6.3, PAGE 6-1.**

B. Reusable Probes

1. PAT-101 - Patient probe--Rectal/Esophageal - Adult (10' long).
2. PAT-102 - Patient probe--Rectal/Esophageal - Pediatric (10' long).
3. PAT-108 - Patient probe--Skin Surface (10' long).

2.0 PRINCIPLES OF OPERATION

The Gaymar Automatic Patient Control system is designed to regulate patient temperature by the application of hypothermia blankets through which temperature controlled water is circulated.

Gaymar's machine may be operated to provide patient therapy in two basic modes, **AUTOMATIC** and **MANUAL**. In Automatic mode (with Patient Probe), patient temperature is automatically regulated to an operator specified set point. While in **MANUAL** mode, the operator must observe the patient temperature and adjust the blanket water temperature to obtain the desired results.

MEDI-THERM also features a convenient means of monitoring patient temperature without providing therapy. This third operating mode, Patient Temperature Monitoring, is achieved by utilizing the Patient Probe and placing the unit in the **PATIENT TEMP NO THERAPY** mode.

2.1 OPERATOR CONTROLS/INDICATORS

For operator controls and indicators see Figure 6.4, Page 6-2.

① **PATIENT TEMPERATURE** - displays patient temperature to the nearest 0.1°C, .1°F (see Item #22).

② **BLANKET WATER TEMPERATURE** - displays blanket water temperature to the nearest 1°C, 1°F (see Item #22).

③ **COOL** - when illuminated, indicates controller is calling for cool water -- minimum temperature, 4°C.

④ **IN TEMP ZONE** - when illuminated, indicates the unit is controlling at the desired temperature setting.

⑤ **HEAT** - when illuminated, indicates controller is calling for warm water -- maximum temperature 42°C.

⑥ **CHECK WATER FLOW** - when illuminated, indicates the flow of water has been restricted.

⑦ **CHECK PATIENT TEMP SETTING** - when illuminated, indicates that the requested patient temperature setting is not within the normal range (25°C - 45°C) for patient temperature control. At this time, therapy has been interrupted: blanket water is being circulated, but not heated or cooled. Recheck the setting.

⑧ **CHECK PATIENT PROBE** - when illuminated, indicates the temperature of the Patient Probe is below 25°C or above 45°C (out of normal patient temperature range). This alert is accompanied by an audible tone that can be disabled (by pressing Item 21) for five minutes while the problem is being resolved. Check to determine if:

1) Probe is dislodged.
2) Probe is defective.
3) Incorrect probe is being used.

⑨ **MACHINE SHUT-DOWN REMOVE FROM SERVICE** - when illuminated, indicates that all functions except the refrigeration compressor have shut down. This alert will also be accompanied by an audible alarm that cannot be silenced.

⑩ **TEST LIGHTS** - press "**TEST LIGHTS**" switch. Temperature displays should indicate "188°E" and "188.8°E," all machine status legends, 3 mode legends and 2 Temperature Control Switch legends should be lit. The audible alarm should sound.

⑪ **MANUAL BLANKET WATER TEMP** - when illuminated, the unit will control the blanket water temperature to the temperature indicated on the Temperature Control Switch.

⑫ **MANUAL CONTROL** - when illuminated, the unit is operating in the **MANUAL BLANKET** Control mode.

⑬ **MANUAL CONTROL MODE SWITCH** - when pressed, the unit will enter the **MANUAL BLANKET** Control mode.

⑭ **TEMPERATURE CONTROL SWITCH** - used to set temperature in °C only for **BLANKET WATER** temperature or **PATIENT** temperature (depending on operating mode).

⑮ **AUTO CONTROL** - when illuminated, the unit is operating in the **AUTOMATIC PATIENT CONTROL** mode.

⑯ **AUTO CONTROL MODE SWITCH** - when pressed, the unit will enter the **AUTOMATIC PATIENT CONTROL** mode.

⑰ **PATIENT PROBE JACK** - connector is designed to fit machine end of Patient Probe assembly. Use only YSI 400 Series probes or equivalent.

⑱ **PATIENT TEMP MONITOR MODE SWITCH** - when pressed, the unit will only monitor patient's temperature. No therapy is being provided.

⑲ **PATIENT TEMP NO THERAPY** - when illuminated the unit will only monitor patient's temperature. No therapy is being provided.

⑳ **AUTOMATIC PATIENT TEMP** - when illuminated, the unit will control the patient's temperature to the temperature indicated on the Temperature Control Switch.

㉑ **ALARM SILENCE SWITCH** - if the **CHECK PATIENT PROBE** light is illuminated, the audible alarm will sound. Depressing this switch will silence the alarm for approximately five (5) minutes while the problem is being resolved. This switch will not silence the audible alarm in the **MACHINE SHUT-DOWN REMOVE FROM SERVICE** alarm condition.

㉒ **CELSIUS TO FAHRENHEIT CONVERSION SWITCH** - press and hold switch to observe blanket water and patient temperatures in degrees Fahrenheit.

㉓ **ON/OFF SWITCH** - a circuit breaker On/Off Switch that controls the power to the unit.

㉔ **PROBE CHECK WELL** - Perform probe check by inserting probe into sterile sheath and then into probe check well on blanket manifold. Operate unit in **MANUAL** mode with a blanket connected. Set Temperature Control Switch between 33°C and 37°C. Wait until unit stabilized (**IN TEMP ZONE**). Digital temperature displays should read within 2°C of each other. If not, probe may be defective or incorrect probe is being used. If probe appears defective, try another probe. If new, and correct probe does not meet this test, unit may be out of calibration.

CAUTION: **Use protective sheath (B-D catalog #3700 thermometer sheath or equivalent) on probe to prevent cross-contamination.**

NOTE: **THIS WELL IS NOT TO BE USED FOR CALIBRATION.**

㉕ **BLANKET MANIFOLD, BLANKET(S) WATER CONNECTIONS** - machine connector fittings are marked **SUPPLY** and **RETURN**.

㉖ **AIR VENTS** - louvers and screened ventilation openings are located on three sides of the cabinet. Keep clear to assure adequate air circulation.

㉗ **OPERATING INSTRUCTIONS**

㉘ **WATER FILL OPENING** - lift cover to fill unit with distilled water only. Proper level is attained when water just touches the screen.

CAUTION: DO NOT OVERFILL

2.2 THEORY OF OPERATION

Operation of the machine may be best explained by examining the Fluid, Electrical and Refrigeration Systems. Their description follows.

2.2.1 FLUID SYSTEM

The Medi-Therm Unit utilizes a two reservoir system which consists of a cold water reservoir and a warm water reservoir. Physical locations of main system components are shown in Figure 6.20, Page 6-13 and Figure 6.21, Page 6-14 of this manual. In the **MANUAL** mode, the Blanket Water Probe (RT2/RT3) senses the temperature of the water going to the blanket. When the blanket water temperature is within 1°C of the desired setting, the Unit will enter the **IN TEMP ZONE** condition and will remain there so long as the temperature is within 1°C of the **BLANKET WATER** temperature setting.

The cold water reservoir system maintains approximately nine (9) quarts (8.52 liters) of water at 4°C. This reservoir temperature is maintained by the refrigeration controller (S4).

The warm water reservoir contains only a small reserve of water, and when heat is called for, water in the reservoir is quickly heated by means of the cartridge heater. The maximum attainable water temperature in the warm water reservoir is 41.5°C.

2.2.1.1 HEATING

See Figure 6.5, Page 6-3.

2.2.1.2 COOLING

See Figure 6.6, Page 6-3.

2.2.1.3 IN TEMP ZONE

When the Medi-Therm is in the **IN TEMP ZONE**, the water path alternates between heating (Figure 6.5, Page 6-3) and cooling (Figure 6.6, Page 6-3).

2.2.1.4 BACK-UP SYSTEMS

Several back-up systems are incorporated into the unit to assure maximum patient safety.

MAXIMUM WATER TEMPERATURE

To limit maximum water temperature, the following controls are utilized:

A. The primary high temperature back-up sensor (RT1) and associated circuitry limit the maximum average water temperature flowing through the warm water reservoir to 41° ± 0.5°C.

B. The second high temperature back-up sensor (43° to 46.5°C) is the bimetallic thermostat (**S2**). If this thermostat is activated, it, along with associated control circuitry, will activate the **MACHINE-SHUTDOWN REMOVE FROM SERVICE** circuit which automatically shuts down all functions except the refrigeration compressor.

C. Bimetallic thermostat (**S3**) is the third high temperature back-up sensor (47° to 50°C). If this thermostat is activated, it will turn the cartridge heater off and on again when it cools and resets.

MINIMUM WATER TEMPERATURE

Temperature of water in the cold reservoir is controlled by the refrigeration controller (S4) (3.9° to 6.5°C). The bimetallic thermostat (S1), is a low temperature back-up (-2.5° to +3.0°C) for (S4). If S1 activates, the **MACHINE SHUT-DOWN REMOVE FROM SERVICE** circuit is triggered, which in turn shuts down all functions except the refrigeration compressor.

2.2.2 ELECTRICAL SYSTEM

The unit's electronics package utilizes a closed-loop controller with provisions for operator input (temperature set point selection and operating mode selection), status and alert displays, and redundant back-up and safety systems. The controller controls blanket water temperature using an internal water temperature probe, or controls patient temperature using a patient connected probe.

The solid-state design assures reliability and accurate control at the set point while modular construction provides for easy and convenient serviceability.

The electrical system consists of the Power Supply, Interface Circuits, Back-Up and Safety Circuits, Control Circuits, Alert Circuits, Mode Selection Circuits, and Display Circuits.

Component layout and parts designation are shown on Pages 6-15, 6-16, and 6-17. The electrical schematics are shown on Pages 6-4, 6-5, 6-6, and 6-7.

2.2.2.1 POWER SUPPLY

With the exception of Transformer T-1, the unit's Power Supply is completely contained on the A3 Power Supply Printed Wiring Board. The output of T-1 is rectified, filtered, and by means of on-board regulators (A3) Q8 through (A3) Q11, is controlled at output levels of +5, +12, -12, and -5 volts D.C. A full wave rectified lamp supply (L.S.) is used to illuminate status, alert, and legend lamps.

2.2.2.2 INTERFACE CIRCUITRY

Interface Circuitry is also located on the A3 Power Supply Board and consists of (A3) U1 through (A3) U4, (A3) Q1 through (A3) Q4 and associated parts. (A3) U1 through (A3) U4 are optically coupled triac drivers used to control their respective triacs; these combinations provide electrical isolation between the low voltage control circuits and the line voltage power circuits. (A3) U4 and (A3) Q1 control the cold solenoid valve K1 while (A3) U2 and (A3) Q2 control the hot solenoid valve K2. (A3) U3 and (A3) Q3 control the circulating pump while (A3) U1 and (A3) Q4 control power to the heat circuit.

2.2.2.3 BACK-UP CIRCUITRY

The A3 Board also contains the Primary Back-Up Circuit. This is a solid state on/off controller consisting of (A3) U7, (A3) Q5, surrounding components, and RT1 located in the heater manifold in the machine base. Whenever the temperature of the output water exceeds 41° + 0.5°C, (adjustable by A3R1), U7 disables Q5. This circuit operates independently from the main control circuits to turn the heater off to limit the average output water temperature to 41° ± 0.5°C.

Finally, the A3 Board includes the **MACHINE SHUT-DOWN REMOVE FROM SERVICE** circuitry, which includes (A3) Q6, (A3) U6, (A3) U5, (A3) Q7, (A3) CR9, their interconnected components, and fixed, non-adjustable thermostats S1 and S2 in the base. Under normal conditions (A3) Q6 is kept turned on by the action of (A3) R19, (A3) C11 and (A3) CR10 and completes the heater circuit. If the blanket water temperature falls into the range from -3°C to +2.5°C or rises into the range from 43°C to 46.5°C, S1 or S2 respectively will open and full line voltage will appear between (A3) P1 pins 7 and 1. In this case, optical couplers (A3) U6 and (A3) U5 will be turned on. (A3) U6 prevents (A3) Q6 from turning on even after S1 (or S2) has closed again. The electrically isolated output of (A3) U5, buffered by (A3) Q7, results in a signal to the controller which returns the controller to standby status, turns on the **MACHINE SHUT-DOWN REMOVE FROM SERVICE** indicator and enables the audible alarm. This **MACHINE SHUT-DOWN REMOVE FROM SERVICE** condition remains latched up and can be cleared only by turning the machine off. If, upon machine turn on, the fault condition still exists, attempting to apply therapy will cause the **MACHINE SHUT-DOWN REMOVE FROM SERVICE** to reoccur.

The final protective device, bimetallic thermostat S3, is wired only in series with the heater and would regulate the heater for water temperatures in the range from 47°C to 50°C, but will not activate the **MACHINE SHUT-DOWN REMOVE FROM SERVICE** circuit.

2.2.2.4 CONTROL AND ALERT CIRCUITRY

The Control and Alert Circuits reside primarily on the A2 Main Control Board; exceptions are the Flow Switch and Blanket Water Probe Assembly located in the machine base, the **ALARM SILENCER** Switch, Temperature Set Switch, and Patient Probe. The following is a brief description of the Control and Alert Circuitry:

A. Reference Diode (A2) CR1, integrated circuits (A2) U1 and (A2) U2, transistors (A2) Q1 and (A2) Q2, and associated components generate temperature stable references voltages (+Vref and -Vref) at nominal levels of +5 and -5 volts, respectively. Temperature stable resistors are used here and throughout and circuitry, where appropriate, to minimize the effect of ambient temperature changes on system operation.

B. Blanket water temperature sensing thermistors RT2 and RT3 are part of the feedback loop of (A2) U3. The combination of RT2, RT3, (A2) R11 and (A2) R12 is a linearly temperature dependent resistive network. A linear temperature sensitive voltage results at the output of (A2) U3 with zero and span adjustments provided by (A2) R9 and (A2) R6. The voltage at (A2) TP4 is thus linearly dependent on the temperature of the Blanket Water Probe Assembly. This signal goes off the board (A2J2 pin 6) to the A1 Display Board.

C. A circuit (A2) (U4) similar to that described in "B" uses the Patient Probe in its feedback loop to generate a signal at (A2) TP5 that represents **PATIENT** temperature. (A2) R19 linearizes the probe response over the range from +30°C to +41°C so that patient temperature determinations of the required accuracy can be achieved. This signal goes off the board (A2J2 pin 3) to the A1 Display Board.

D. Transistors (A2) Q3 through (A2) Q7 form a single pole double throw switch; under command of the Mode Selection Circuits (by way of A2J2 pin 1) this switch selects either blanket water temperature or patient temperature as the input to the controller. The switch output is buffered by voltage follower (A2) U12; R117 allows offset correction of U12.

E. The controller set point is determined by a three digit Temperature Control Switch. This setting is converted to a voltage by resistor ladder network (A2) R24 through (A2) R34 and (A2) U5. (A2) R35 and (A2) R38 provide span and zero adjustments, respectively.

F. The output from the controller set point circuit (E) and that from the selected probe circuit are compared by error amplifier (A2) U11. If the two levels are unequal, an output of appropriate polarity is developed at the output of (A2) U11. This error signal is thus related to the magnitude and sense of the difference between the set point and the actual temperature. R120 provides offset correction for U11. (A2) U20 and its associated components is an integrator operating on the output of the error amplifier; the integrator is reset by (A2) Q14 through (A2) Q16 whenever the machine is in standby mode or in **PATIENT TEMP NO THERAPY** mode. Otherwise, the output of (A2) U20 is the integral of the difference signal from the error amplifier. (A2) U21 provides unity gain inversion. The difference signal and the integral signal are summed and offset by the circuit including (A2) U10. The resulting control signal is, at (A2) U8A and (A2) U8B, compared to a low frequency sawtooth from (A2) U9. The outputs of (A2) U8A and (A2) U8B are complementary pulse trains whose duty cycle depends on the magnitude and sense of the control signal. That is, while the outputs are either on or off, the ratio to on to off time is proportional to the control signal amplitude. For larger differences between set point and probe temperatures, the controller outputs will be either on or off. For differences approaching zero, the outputs will switch on and off with the on and off times automatically adjusted to maintain a probe temperature equal to the set point. Gates (A2) U7A and (A2) U7D enable the controller outputs only in the manual and automatic control modes as commanded by mode selection circuits via A2J3 pin 1. Transistors (A2) Q10 and (A2) Q11 buffer the gate outputs and drive the heater, hot solenoid and cold solenoid through outputs on A2P2 pins 18, 17, and 16 respectively.

G. The output of (A2) U11 is tied to inputs of (A2) U14 where it is compared to voltages of plus two volts and minus two volts; these two voltages are equal to the error amplifier outputs when the actual temperature differs from the set point temperature by minus or plus one degree Celsius. Therefore, if the actual temperature differs from the set point temperature by more than one degree Celsius, one output of (A2) U14 will be low and a high output on (A2) J9 pin 9 or 11 will command either the **COOL** or **HEAT** status light on. If, on the other hand, there is less than one degree Celsius difference between set point and actual temperatures, both outputs of (A2) U14 will be high, the **HEAT** and **COOL** lights will be off, and a high output on (A2) J3 pin 10 will command the **IN TEMP ZONE** status light on. (A2) U16B, C, and D provide the logic to enable these status indicators only when **AUTOMATIC** or **MANUAL CONTROL** mode has been selected (low level input on A2J3 pin 1).

H. When automatic control is selected (low level at A2J3 pin 2) U16A is enabled. Thus, when in **AUTOMATIC** mode and the patient temperature is more than one degree different than the set point, U17 is enabled and outputs a pulse waveform.

A2J3 pin 3 is low anytime the Patient Probe is in use; A2J3 pin 4 will then also be a pulse waveform that will cause the patient temperature display to flash on and off. For all other conditions requiring patient temperature display, the display will remain on without flashing.

I. Alert Circuits

"CHECK PATIENT PROBE" - The function of this circuit is to verify the integrity of the patient probe system. To this end, the output of the patient probe circuit (A2) U4 is brought to (A2) U6 where it is compared to two limits; these limits are set to correspond to patient temperatures of 25°C and 45°C. In the normal case where the output of (A2) U4 represents a patient probe temperature between the two limits, the outputs of (A2) U6 will both be high. When the probe appears to be at a temperature outside the limits, one output of (A2) U6 will go low. (A2) U15C, enabled whenever the probe is in use (A2J3 pin 3 low), will then command the **CHECK PATIENT PROBE** light on (A2J3 pin 12 high). The output of (A2) U7C will drive the audible alarm on. One-half of (A2) U18 is a nominal five minute timer; pressing the **ALARM SILENCER** Switch, S6, momentarily will start the timer which will disable U7C thereby turning off the alarm tone giving the operator approximately five minutes of silence to investigate the problem.

(A2 U15B is enabled only in the **AUTOMATIC** mode (A2J3 pin 2 low); a **"CHECK PATIENT PROBE"** condition then will turn on (A2) Q8 and (A2) Q9. Regardless of what the controller is requiring, (A2) Q8 will turn off the heater and close the cold solenoid while (A2) Q9 will open the hot solenoid. This will prevent the machine from controlling based on a patient probe that is disconnected, dislodged, defective, or for any other reason appears to be at a temperature less than 25°C or above 45°C. In addition to discontinuing therapy, the output of (A2) U15B, through diode (A2) CR15, disables the **HEAT**, **COOL**, and **IN TEMP ZONE** status lights so that there is also no indication of therapy.

"CHECK PATIENT TEMP SETTING" - The function of this circuitry is to prevent the machine from controlling patient temperature at a set point that is abnormal.

The output of the set point circuit is compared to two limits by (A2) U13; the limits correspond to temperatures of 25°C and 41°C. When the set point is between these limits, the outputs of (A2) U13 are high. Otherwise, one output will go low and (A2) U15A, enabled only in the **AUTOMATIC** mode, provides a high output at A2J3 pin 13 to command the **CHECK PATIENT TEMP SETTING** light on. This same output, through (A2) CR23, turns off the status lamps; it also turns on (A2) Q8 and (A2) Q9 whose functions are as described in the **CHECK PATIENT PROBE** discussion. In automatic control, the controller will not respond to a set point below 25°C or above 41°C.

"CHECK WATER FLOW" - The function of this circuitry is to indicate when the flow through the unit drops below 12 + 2 GPH (45.42 ± 7.57 LITERS/HR.). This indicator can only be enabled in the **MANUAL** or **AUTOMATIC** mode. This enable is controlled by (A1) U2C, (A1) U3D, and (A1) U5C. The contacts of the flow switch, S5, are closed with low flow. A signal is then fed to (A1) Q9 which enables the **CHECK WATER FLOW** indicator.

"MACHINE SHUT-DOWN REMOVE FROM SERVICE" - (See Section 2.2.2.3)

J. Whenever any alert condition occurs, A2J3 pin 14 goes low, (A2) Q12 turns off and one-half of (A2) U18 outputs a pulse waveform on A2J3 pin 8 to flash the **ALERT** light on and off.

(A2) U19 provides the signal to drive AA1, the audible alarm. (A2) U19 generates a low frequency square wave to turn on and off the piezoelectric sounder AA1. This entire circuit is turned on by (A2) Q13 in response to **CHECK PATIENT PROBE, MACHINE SHUT-DOWN REMOVE FROM SERVICE** or **TEST LIGHTS.**

2.2.2.5 MODE SELECTION AND DISPLAY CIRCUITS

Mode selection is accomplished by momentary operation of one of three pressure sensitive mode switches attached to the A1 Display Board. These momentary signals set and reset the appropriate latch circuits of (A1) U2 to retain the selected mode. These latch circuits include power-on-reset networks to assure that the standby mode is established at the time of initial machine turn on.

(A1) U3A, B, C, D buffer the latch outputs. (A2) U4A, B, C provide the logic to allow use of a patient probe during manual control. Latch outputs to the control circuits are provided where required; the outputs are also used to light front panel legends and displays as required. In the event of a **MACHINE SHUT-DOWN REMOVE FROM SERVICE** condition (A1J2 pin 13 high) all latches are reset to the standby condition. The various status and alert lights are turned on by their respective driver transistors in response to appropriate inputs to the A1 Board. Amplifier circuit (A1) U17 implements the conversion of Blanket Water Temperature from degrees Celsius to degrees Fahrenheit. Arithmetically, conversion requires multiplication by 1.8 (equivalent to gain) and addition of 32 (equivalent to offset). (A1) R84 provides the adjustment of offset while (A1) R73 allows adjustment of gain. (A1) CR44 provides a stable level from which to derive the offset voltage. Amplifier circuit (A1) U19 performs the same function for **PATIENT** temperature.

The input to and output from (A1) U17 are fed to multiplexer (A1) U18; similarly, the input and output of (A1) U19 are also fed to the multiplexer. Ordinarily, the amplifier inputs (temperatures in degrees Celsius) pass through the multiplexer and become inputs to the temperature displays. At the same time, +5 volts passes through (A1) U18 to form a °C indicator in the trailing seven segment displays, (A1) U13 and (A1) U15. However, when the temperature conversion switch is pressed, the outputs (temperatures in degrees Fahrenheit) of (A1) U17 and (A1) U19 pass through (A1) U18 to become inputs to the temperature displays. At the same time, +5 volts passes through (A1) U18 to (A1) U1G and a °F indicator is formed in each temperature display. Analog to digital converter (A1) U6 and digital displays (A1) U7, U8 and U14 constitute a digital meter whose sensitivity is adjusted by (A1) R46. Its input is blanket water temperature; the resultant display is blanket water temperature to the nearest degree. Similarly, (A1) U9, 10, 11, 12, and U16 constitute another digital meter with sensitivity adjusted by (A1) R51. Its input is patient temperature; the resultant display is patient temperature to the nearest one-tenth of a degree.

The output from the **TEST LIGHTS** switch goes off the board (A1J1 pin 7) to turn on the audible alarm. It also turns on (A1) Q12 and (A1) Q13 which turn on all status, alert, and legend lamps. It also applied +5 volts to pin 37 of (A1) U6 and (A1) U12 to cause all the display digit segments to illuminate.

2.3 REFRIGERATION SYSTEM (Refer to Figure 6.11 on Page 6-8)

The refrigeration circuit consists of two heat exchangers operating at two pressures and two devices used to change these pressures. The first of these devices is the compressor which changes the gas pressure from low to high. The other device is the capillary tube which reduces the refrigerant pressure from high to low.

Beginning the cycle at the capillary tube, high pressure liquid refrigerant flows in the capillary tube and is discharged into the evaporator coil. The evaporator coil, which is a heat exchanger, receives the refrigerant as a mixture of liquid vapor at a pressure low enough so that it boils and absorbs heat from the water surrounding it.

The heated refrigerant vapor then leaves the evaporator coils, enters the suction side of the compressor and is compressed, causing its pressure and temperature to increase. The vapor, much warmer than the ambient air, travels to the condenser.

The condenser is another heat exchanger. The condenser fan draws the colder ambient air over the condenser coils and removes the heat being carried by the refrigerant and causes it to condense back into liquid refrigerant. This completes the cycle and the high pressure liquid refrigerant is returned to the capillary tube to be used over again. The temperature of the water being cooled which surrounds the evaporator coil is controlled by the set temperature of the controller whose sensing bulb is located adjacent to the evaporator coil. The controller will turn the compressor on and off at the set temperatures. See Figure 6.11 on Page 6-8.

3.0 INSPECTION, CLEANING AND PREVENTIVE MAINTENANCE PROCEDURES

3.1 RECEIVING INSPECTION PROCEDURES

CONCEALED LOSS OR DAMAGE

After unpacking unit, inspect the unit for concealed loss or damage. Save all packing material and carefully describe or photograph the damage. Notify the carrier at once and ask for an inspection (in writing). Failure to do this within 15 days may results in loss of claim. Do not return the unit to **GAYMAR**---call our Technical Service Department for advice.

Perform a visual and mechanical inspection of the unit by removing the wrap around from the cabinet and the top cover. To remove the wrap around and top cover, see Figure 6.18 on Page 6-11.

IMPORTANT!!

BEFORE THE UNIT IS OPERABLE, THE COMPRESSOR TIE-DOWNS MUST BE REMOVED. SEE FIGURE 6.25, PAGE 6-18.

The following functional checks should be made on the Hyper/Hypothermia Unit:

TEST EQUIPMENT SUGGESTED:

- GAYMAR TPT-9 Tester
- Mercury thermometer (±1°C accuracy) -2°C to 52°C, Brooklyn Thermometer, Type 73544, Gaymar P/N: TFC-1, or equivalent
- GAYMAR Hyper/Hypothermia Pad, DHP-901
- Blanket Connecting Hose, DBK-5
- Current Leakage Tester

A. Connect the unit as shown in Figure 6.12 on Page 6-9.

B. Fill the unit with distilled water per instructions on unit.

C. Set the Temperature Control Switch to 30°C. Turn unit on.

D. Press the **MANUAL CONTROL** Switch.

E. The flow rate on the TPT-9 Tester should indicate above 16 GPH (60.57 liters/hr.)

F. After the unit has stabilized, the mercury thermometer should indicate 30 ± 1°C.

G. The **BLANKET WATER** display on the unit should indicate 30 ±1°C.

H. Set the Temperature Control Switch to 49°C. The maximum blanket water temperature should be 41° ±0.5°C.

I. Set the Temperature Control Switch to 0°C. The minimum blanket water temperature should be 4° ±1°C.

J. Perform current leakage test.

K. Initial check-out procedure is complete.

3.2 CLEANING PROCEDURES

3.2.1 FLUID SYSTEM

The water circulation system, including blankets, should be cleaned every month to retard algae growth. Drain the unit and prepare a germicidal solution (Airwick A-33 or equivalent) according to manufacturer's instructions. Add the solution to the unit, attach blankets, and circulate with the Temperature Control Switch set at 27°C for 2 hours. Drain the solution and refill the unit with distilled water.

Algae growth may be retarded by using distilled water and changing it regularly and by adding the recommended amount of germicide or sanitizer (Airwick A-33 or equivalent) to the water.

CAUTION: DO NOT use bleach (sodium hypochlorite).

NOTE:

1. **Distilled water is recommended to retard algae growth and mineral build-up. It should be changed monthly or more often depending upon use.**
2. **Do not exceed proper germicidal solution concentration; damage could occur to the circulating pump (from foaming).**

3.2.2 COMPRESSOR

Dirt that has accumulated on the condenser cooling fins within the machine should be removed with a vacuum cleaner or compressed air hose. This will require removal of the wrap around panel. This should be checked monthly or more frequently depending upon use. See Figure 6.18 on Page 6-11.

* To oil compressor fan motor, remove rubber plug on top of fan motor, add 3-4 drops of a general purpose motor oil once a year and reinstall plug.

3.2.3 PUMP

Pump motor should be oiled with 3-4 drops of general purpose motor oil (typical 2 places) once a year.

3.2.4 PANEL EXTERIOR

Clean the control panel and panel exterior with a cloth dampened with isopropyl alcohol.

3.2.5 BLANKETS

Standard blankets may be cleaned with a damp cloth and mild detergent to prevent algae growth. Attach the blankets to the unit and follow instructions under Section 3.2.1.

If blankets must be sterilized, use any cold sterilization means except alcohol. If gas sterilization is necessary, pads are made of PVC and should be handled like any other PVC product.

NOTE: **Gas Sterilization temperature must not exceed 63°C (145°F).**

ALSO NOTE: **Exposure to harsh chemicals will cause pads to lose flexibility and resistance to cracking.**

3.2.6 PROBE CHECK WELL

The Probe Check Well should be cleaned with a small tubular brush and detergent, and then wiped with a commercial disinfectant.

3.2.7 PROBES, REUSABLE

Do not autoclave. Clean with a damp cloth and mild detergent. Wipe dry.

If probe must be sterilized, use any cold sterilization means except alcohol. Always wipe dry. If gas sterilization is necessary, probes are made of PVC and should be handled like any other PVC product.

NOTE: **Gas sterilization temperature must not exceed 63°C (145°F).**

ALSO NOTE: **Exposure to harsh chemicals will cause probe to lose flexibility and resistance to cracking. Do not use damaged temperature probes. Discard probes having visible pinholes, cracks or abrasions.**

3.2.8 PROBES, DISPOSABLE

Be certain proper adaptor is used. (See specifications, Page 1-7).

3.3 FUNCTIONAL CHECK-OUT AND SAFETY INSPECTION

To assure the optimum performance, dependability and safety, the following preventive maintenance procedures should be performed every three (3) months. An Inspection Form is provided at the end of this section to facilitate the Inspection Process.

IMPORTANT: ALWAYS PERFORM FUNCTIONAL CHECK-OUT AND SAFETY INSPECTION AFTER MAKING REPAIRS AND BEFORE RETURNING MEDI-THERM FOR PATIENT USE. IMPROPER REPAIR COULD RESULT IN PATIENT INJURY.

3.3.1 PROCEDURES/EQUIPMENT

The following test equipment is suggested to perform the preventive maintenance procedures:

- **GAYMAR** TPT-9 Tester
- Mercury Thermometer (±1°C accuracy) -2°C to 52°C Brooklyn Thermometer Type 73544, Gaymar P/N: TFC-1, or equivalent
- Blanket Connecting Hose DBK-5
- Precision Decade Box* (0-9999 OHMS, 0.2% accuracy, 1 OHM steps)
- **GAYMAR** Hyper/Hypothermia Pad DHP-901
- Ground Resistance Checker
- Current Leakage Tester

NOTE: **If you do not wish to purchase a precision decade box, precision resistors (pre-wired to 1/4" phone plugs) are available from Gaymar (order PRK-2, Precision Resistor Kit).**

OPTIONAL TEST EQUIPMENT - Gaymar testers TA-700 (top) and TMT-4000 (base) are dedicated test tools available from Gaymar Industries. These tools allow independent testing of top and base and provide all connections and inputs for easier calibration. Consult the Technical Service Department.

A. Condition of Chassis. Examine the exterior of the unit for overall condition. The chassis should be clean and relatively free of rust and corrosion. Exterior screws should be tight. Legends and markings should be legible. Dirt that has accumulated in vents and cooling fins within the machine should be removed with a vacuum cleaner or compressed air hose. This will require removal of the chassis wrap around. Check that the casters are functioning properly.

The metal quick-disconnect fittings on the unit may become stiff and difficult to engage. The problem can be eliminated by applying a silicone base lubricant to the inside of the machine fittings and the outside of the blanket connector. Clean Probe Check Well according to procedures described in Section 3.2.6.

B. Attachment Plug. Examine the attachment plug on the line cord to be sure that it is in good condition.

C. Ground Resistance. Use an ohmmeter to measure the resistance between the grounding pin on the line cord attachment plug and an exposed metal point on the chassis. The value should be less than 0.15 ohms.

D. Line Cord and Strain Reliefs. Examine the line cord along its entire length for physical damage, such as cut or cracked insulation. A damaged line cord should be replaced rather than repaired. Check the quality of the strain reliefs at both ends of the line cord.

E. Circuit Breaker. Examine the physical condition of the circuit breaker.

F. Position of Temperature Control Switch. Before moving the temperature control, note whether it is left in normal positions by previous user. A temperature control that is at the end of its range, for example, might indicate a machine malfunction or inadequate training of clinical personnel.

G. Condition of Lights, Alarm, and Temperature Indicators. Plug in and turn unit on. Press **"TEST LIGHTS"** switch. Temperature displays should indicate "188°E and 188.8°E", all machine status legends, 3 mode legends and 2 Temperature Control Switch legends should be lit. The audible alarm should sound.

H. Current Leakage, CHASSIS. Measure the maximum current leakage between the chassis and the ground in all operating configurations (heating, cooling, compressor **ON**, compressor **OFF**,normal and reverse polarity). The current leakage should not exceed microamperage indicated in table below.

Current Leakage, GROUNDED PATIENT PROBE. It is first necessary to prepare a patient probe by wrapping it tightly along its entire length with metal foil. Then measure current leakage at the foil for all combinations: grounded, ungrounded, normal polarity, and reversed polarity. (See table below.)

CHASSIS LEAKAGE	MTA-4700/4701	MTA-4702
Unit Grounded	10 microamps	20 microamps
Unit Ungrounded	100 microamps	200 microamps
Probe Leakage	50 microamps	100 microamps

NOTE: **If additional information is required, refer to AAMI Safety Standard for Safe Current limits or contact GAYMAR INDUSTRIES, Technical Service Department.**

I. Flow Rate. To measure the unit's flow rate, perform the following:

1. Make sure unit is filled with distilled water.
2. Connect the test set-up shown in Figure 6.12 on Page 6-9.
3. Set the temperature control to 30°C.
4. Turn unit on. Set unit in **MANUAL** mode.
5. The flow rate should exceed 16 GPH (60.57 liters/hr.).
6. Test is complete.

J. Flow Switch Activation (S5). To measure the level at which the flow switch activates, perform the following:

1. Connect the test set-up as shown in Figure 6.12 on Page 6-9.
2. Set the temperature control to 30°C.
3. Turn unit on. Set unit in **MANUAL** mode.
4. The flow rate should be at least 16 GPH (60.57 liters/hr.).
5. By kinking the hose, the flow rate should drop. When the flow drops to 12 ±2 GPH (45.42 ±7.57 liters/hr.), the **CHECK WATER FLOW** indicator should light and the **ALERT** indicator should flash on and off.
6. Test is complete.

K. Third High Temperature Back-Up Thermostat (S3). To measure the setting of the third back-up thermostat, perform the following:

1. Disconnect from wall outlet.
2. Connect the test set-up as shown in Figure 6.12 on Page 6-9 and remove wrap around cover (Figure 6.18 on Page 6-11).
3. Disconnect J2 and P2 at the warm water reservoir (Figure 6.18 on Page 6-11).
4. Remove cover from terminal block (TB1); cover is white plastic located to the right and below the J2P2 connector shown in Figure 6-18 on Page 6-11. Short out terminals 8 and 9. Install neon test light across terminals 8 and 10.

   NOTE: **Be sure leads are long enough to extend outside the wrap around cover.**

5. Replace wrap around cover. It is not necessary to install screws. Be sure to expose neon test light.

6. Set Temperature Control Switch to 41°C. Reconnect unit to wall outlet and turn on. Set in **MANUAL** mode.
7. Run unit for 15 minutes after water temperature reaches 41°C.
8. Turn unit off. Raise A-700 Top Cover and locate A2 Control Board.
9. Unplug Temperature Control Switch, connector J1 on A2 Control Board. Replace Top Cover to normal position. Turn unit on and set in **MANUAL** mode.

   The temperature on the mercury thermometer should be 47° to 50°C when the neon test light goes out.

   NOTE: **The neon test light will not cycle back on until the temperature drops between 36° and 42°C. Observe a few cycles to verify the CUT-OUT temperature.**

10. Turn unit off.

    NOTE: **Since the temperature of the S2 thermostat has been exceeded, it will be necessary to cool the machine before proceeding to Paragraph "L".**

11. Plug in Temperature Control Switch and set at 30°C. Run machine in **MANUAL** mode for 3 minutes.
12. Turn off machine. Remove neon light and shorting cable.
13. Reconnect J2 and P2.
14. Test is complete.

L. **Second High Temperature Back-Up Thermostat (S2).** To measure the setting of the second back-up thermostat, perform the following:

1. Connect the test set-up as shown in Figure 6.12 on Page 6-9 and remove wrap around cover (see Figure 6.18 on Page 6-11).
2. Disconnect J2 and P2 at warm water reservoir (Figure 6.18 on Page 6-11). Replace wrap around cover. It is not necessary to install screws.
3. Set the Temperature Control Switch at 41°C. Turn unit on. Set in the **MANUAL** mode.
4. Run unit for 15 minutes after water temperature reaches 41°C.

5. Set Temperature Control Switch to 49.9°C and run unit until it shuts down. The temperature on the mercury thermometer should be between 43° and 46.5°C when the unit shuts down; the **MACHINE SHUT-DOWN REMOVE FROM SERVICE** indicator should light and the audible alarm sound.
6. Turn unit off.

   NOTE: **Since the temperature of the S2 thermostat has been exceeded, it will be necessary to cool the machine before proceeding to Paragraph "M.".**

7. Short terminals 8 and 9 on TB1.
8. Set Temperature Control Switch at 30°C. Run machine in **MANUAL** mode for 3 minutes.
9. Turn machine off. Remove shorting cable.
10. Reconnect J2 and P2.
11. Test is complete.

M. **Primary High Temp Sensor (RT1).** To measure the setting of the Primary Sensor, perform the following:

1. Connect the test set-up shown in Figure 6.12 on Page 6-9.
2. Set the Temperature Control Switch at 49°C.
3. Turn unit on. Set in **MANUAL** mode. The average water temperature on the mercury thermometer should stabilize at 41° ± 0.5°C. See Section 3.5.1, Paragraph "E." for proper measurement procedure.
4. See Primary Back-Up Adjustment, Section 3.5.1, if adjustment is necessary.
5. Test is complete.

N. **Low Temperature Back-Up Thermostat (S1).** The low temperature back-up thermostat is factory set to limit low temperatures between + 2.5°C and -3.0°C. It is not necessary to test the set point as part of this functional test. If there is reason to test this thermostat, perform the following:

1. Disconnect unit from wall outlet.
2. Remove top cover from unit and disconnect J1 from top cover (Figure 6.18 on Page 6-11).
3. Connect **GAYMAR** shorting plug, P/N 77352-000 to J1.

4. Place the ohmmeter across the contacts of S1 (Figure 6.6 on Page 6-3). The resistance should be zero.
5. Connect Jumpers onto refrigeration control (S4) shown in the Figure 6.13 on Page 6-9.
6. Add seven (7) quarts (6.62 liters) of water and two (2) quarts (1.89 liters) of alcohol to reservoir.
7. Connect the test set-up shown in Figure 6.13 on Page 6-9.
8. Reconnect unit to wall outlet and turn on.
9. When the contacts of S1 open up, the ohmmeter should read infinity and the mercury thermometer should reach between +2.5° to -3.0°C.
10. Turn unit off.
11. Remove ohmmeter.
12. Turn unit on.
13. Drain unit of water and alcohol mixture by connecting a DBK-5 connector to the supply fitting on unit. Turn unit off and disconnect DBK-5.
14. Remove shorting plug and resintall top cover.
15. Refill with distilled water.

O. **Refrigeration Controller (S4).** To measure the setting of the refrigeration controller, perform the following:

1. Connect the test set-up shown in Figure 6.12 on Page 6-9.
2. Set the Temperature Control Switch to 0°C.
3. Turn unit on and set in **MANUAL** mode.
4. After the temperature stabilizes, the refrigeration unit should turn on when the water temperature reaches 5.2° to 6.5°C and turn off when the water temperature reaches 3.9° to 4.5°C.

P. **Blanket Water Temperature Controller and Display.** To check the accuracy of the temperature controller and display, perform the following:

1. Connect the test set-up shown in Figure 6.12 on Page 6-9.
2. Turn unit on. Set in **MANUAL** mode.
3. Set the Temperature Control Switch to the various settings specified on the Log Sheet and record the temperature of the mercury thermometer and that shown on the display.

Q. **Check Patient Probe Indicator and Alarm.** To measure the accuracy of the trip points for the check probe signal, perform the following:

1. Connect the test set-up shown in Figure 6.14 on Page 6-9.
2. Turn unit on. Set in **AUTOMATIC** mode.
3. Set the decade box to the various settings specified on the Log Sheet and check that the **CHECK PATIENT PROBE** indicator, the flashing **ALERT**, and alarm tone are tripping at the proper points.

R. CHECK PATIENT PROBE ALARM SILENCER Delay. To measure the delay time for the **ALARM SILENCER**, perform the following:

1. Turn unit on and set the unit in the **PATIENT TEMP NO THERAPY** mode without plugging in the patient probe.
2. The **CHECK PATIENT PROBE** indicator should be lit. The **ALERT** indicator should flash on and off, and the audible alarm should sound.
3. Press the **ALARM SILENCER** switch; the audible alarm should turn off and stay off for 4 to 8 minutes.

S. CHECK PATIENT TEMP SETTING. To measure the trip points for the **CHECK PATIENT TEMP SETTING** indicator, perform the following:

1. Connect the test set-up shown in Figure 6.14 on Page 6-9.
2. Set the decade box to 1355 ohms (or 37°C probe - PRK-2).
3. Turn the unit on and set it in the **AUTOMATIC** mode.
4. Set the Temperature Control Switch to the various settings specified on the Inspection Form and check that the "**CHECK PATIENT TEMP SETTING**" indicator turns on and off at the proper points.

T. AUTOMATIC CONTROL Mode Check.

1. Connect the test set-up as shown in Figure 6.14 on Page 6-9.
2. Set the decade box to 1355 ohms (or 37°C Probe - PRK-2).
3. Turn unit on and set it in the **AUTOMATIC** mode.
4. Set the Temperature Control Switch to the various settings specified on the Inspection Form and check that the status lights indicate at the proper settings.

U. Check PATIENT Temperature Display Accuracy.

1. Connect the test set-up as shown in Figure 6.14 on Page 6-9.
2. Set the decade box to 1355 ohms (or 37°C Probe - PRK-2).
3. Turn unit on and set it in the **MANUAL** mode.
4. **PATIENT** Temperature Display should indicate 37° ±0.5°C. Log appropriate value on Inspection Form.
5. Press the Celsius to Fahrenheit Conversion Switch. The Patient Temperature Display should indicate 98.6°F ±0.5°F.

This completes the recommended function test and preventive maintenance procedures for the Gaymar Medi-Therm.

If a machine passes all the requirements of Paragraph "A." through "U.", the machine should be considered operational and suitable for return to service.

HYPER/HYPOTHERMIA FUNCTIONAL CHECKOUT/INSPECTION FORM *

LOCATION ______________________________ SERIAL NO.'S (BASE) __________

(TOP) __________

				OK	ACTION NEEDED	ACTION TAKEN (DATE & INITIALS)
A.	Condition of Chassis					
B.	Condition of Attachment Plug					
C.	Ground Resistance less than 0.15 OHMS					
D.	Line Cord and Strain Reliefs					
E.	Circuit Breaker					
F.	Position of Temperature Control Switch between 4°C and 42°C					
G.	Condition of lights and alarm					
H.	Current Leakage					
	CHASSIS:	MTA-4700/ 4701	MTA-4702			
	Ungrounded (microamps max.)	100	200			
	Grounded	10	20			
	PATIENT PROBE:					
	Grounded	50	100			
I.	Flow Rate: Greater than 16 GPH (60.57 litres/hour)					
J.	Flow Switch Activation: 12 ± 2Gph (45.42 ± 7.57 litres/hour)					
K.	Third High Temperature Back-Up Thermostat (S3): 47°C to 50°C					
L.	Second High Temperature Back-Up Thermostat (S2):43°C to 46.5°C					
M.	Primary Back-Up High Temperature Sensor (RT1) 41 ± 0.5°C					
N.	Low Temperature Back-Up Thermostat (S1): + 2.5°C to -3.0°C					
O.	Cold Water Reservoir Controller (S4): 3.9°C to 6.5°C					

* Complete entire Functional Checkout/Inspection form prior to troubleshooting.

<table>
<tr><th></th><th></th><th>OK</th><th>ACTION NEEDED</th><th>ACTION TAKEN (DATE & INITIALS)</th></tr>
<tr><td>P.</td><td>Temperature Controller Display
<table>
<tr><th>Temperature Control Setting</th><th>Display Reading</th><th>Mercury Thermometer Reading</th></tr>
<tr><td>10°C</td><td></td><td></td></tr>
<tr><td>25°C</td><td></td><td></td></tr>
<tr><td>37°C</td><td></td><td></td></tr>
</table>
Display Readings within 1°C of Temperature Control Switch
Mercury Thermometer Reading within 1°C of Temperature Control Switch</td><td></td><td></td><td></td></tr>
<tr><td>Q.</td><td>Check Probe Indicator and Alarm
<table>
<tr><th>Temp</th><th>PRK-2 or Decade Box Setting(OHMS)</th><th>Alarm</th><th>Check Probe Alert</th></tr>
<tr><td>24°</td><td>2354</td><td>On</td><td>On</td></tr>
<tr><td>25°</td><td>2252</td><td>Off</td><td>Off</td></tr>
<tr><td>44°</td><td>1023</td><td>Off</td><td>Off</td></tr>
<tr><td>45.5°C</td><td>965</td><td>On</td><td>On</td></tr>
</table></td><td></td><td></td><td></td></tr>
<tr><td>R.</td><td>Alarm stays off for four (4) to eight (8) minutes</td><td></td><td></td><td></td></tr>
<tr><td>S.</td><td>Check Patient Temperature Setting
<table>
<tr><th>Temperature Control Switch Setting</th><th>Check Patient Temperature Alert</th></tr>
<tr><td>24°</td><td>On</td></tr>
<tr><td>26°</td><td>Off</td></tr>
<tr><td>40°</td><td>Off</td></tr>
<tr><td>42°</td><td>On</td></tr>
</table></td><td></td><td></td><td></td></tr>
<tr><td>T.</td><td>Check Automatic Mode
<table>
<tr><th>Decade Box Setting</th><th>Temp. Control Switch Setting</th><th>IN TEMP LIGHT</th><th>COOL LIGHT</th><th>HEAT LIGHT</th></tr>
<tr><td>37°C/1355</td><td>35.5</td><td>Off</td><td>On</td><td>Off</td></tr>
<tr><td>37°C/1355</td><td>38.5</td><td>Off</td><td>Off</td><td>On</td></tr>
</table></td><td></td><td></td><td></td></tr>
<tr><td>U.</td><td>Check Patient Temperature Display
<table>
<tr><th>Decade Box Setting</th><th>Patient Temperature Display</th></tr>
<tr><td>1355</td><td>37°C+1/2°C</td></tr>
<tr><td></td><td>(98.6°F+1/2°F)</td></tr>
</table></td><td></td><td></td><td></td></tr>
</table>

3.4 P.C. BOARD CALIBRATION PROCEDURE

IF YOU ARE TROUBLESHOOTING DO NOT USE THIS SECTION UNTIL YOU HAVE COMPLETED ALL THE FUNCTIONAL TESTS OUTLINED IN SECTION 3.3. EXPERIENCE HAS SHOWN THAT CALIBRATION ADJUSTMENTS ARE SELDOM NEEDED. MAKE CALIBRATION ADJUSTMENTS ONLY WHEN YOU HAVE EXHAUSTED ALL OTHER POSSIBLE PROBLEM SOURCES.

EQUIPMENT REQUIRED

1. Precision Decade Box — 0 to 99,999 ohms, 1 ohm steps, ±0.2%
2. Digital Voltmeter — 3-1/2 digit, 1.999 volts full scale
19.99 volts full scale
3. Two Conductor (Tip and Sleeve) Phone Plug
4. Test connector Gaymar P/N 05559-000.
5. Optional Test Equipment - Gaymar testers TA-700 (top) and TMT-4000 (base) are dedicated test tools available from Gaymar Industries. These tools allow independent testing of top and base and provide all connections and inputs for easier calibration. Consult the Technical Service Department.

3.4.1 A3 POWER SUPPLY BOARD (REFER TO FIGURE 6.24, PAGE 6-17)

IMPORTANT --- STEPS 1 THROUGH 6 VERIFY POWER SUPPLY BOARD VOLTAGES. CALIBRATION OF R1 ON THE POWER SUPPLY BOARD REQUIRES A COMPLETELY ASSEMBLED MEDI-THERM, AND IS OUTLINED IN SECTION 3.5.1.

1. Install Power Supply Board in top cover.
2. Connect 120 VAC to board as follows using test connector Gaymar P/N 05559-000:

   High side to A3P1 pin 13 (black wire)
   Common side to A3P1 pin 7 (white wire)

   NOTE: When using A-702 (220 volt), maximum voltage for calibration procedure is 120 volts AC. For A-701, maximum voltage is 100 V.

3. Transformer T1 connected to A3P2.
4. Connect common lead of digital voltmeter to A3P3 pin 4 or pin 8.
5. Turn 120 VAC on.

6. Measure the following:

A3P3

Pin 5	-11.5 to -12.5 volts D.C.
Pin 6	- 4.8 to - 5.2 volts D.C.
Pin 9	+11.5 to +12.5 volts D.C.
Pin 10	+ 4.8 to + 5.2 volts D.C.

7. Turn off 120 VAC.

3.4.2 A2 CONTROL BOARD (REFER TO FIGURE 6.23, PAGE 6-16 AND FIGURE 6.18, PAGE 6-11)

1. Disconnect cover from the base. Connect the decade resistor between pin 9 (red wire) and 15 (blue wire) of A3P1 of the Power Supply Board. Connect the common side of the digital meter to ground at TP1 (Test Point One). (See Figure 6.23 on Page 6-16.) Connect 120 VAC to Power Supply Board as follows:

   High Side to A3P1 pin 13 (black wire)
   Common Side to A3P1 pin 7 (white wire)

2. Measure the following:

A2P2

Pin 4	- 4.8 to - 5.2 VDC
Pin 5	+ 4.8 to +5.2 VDC
Pin 13	+11.5 to +12.5 VDC
Pin 14	-11.5 to -12.5 VDC
TP 10	+ 2.39 to +2.59 VDC
TP 5	+ 4.69 to + 5.28 VDC
TP 2	- 4.60 to - 5.39 VDC

3. Select **MANUAL** mode. Set the decade box to 23920 ohms (0°C water probe) and adjust R9 for 0.000 VDC at TP4.
4. Set the decade box to 7946 ohms (40°C water probe) and adjust R6 for 0.400 VDC at TP4.
5. Set the decade box for 10072 ohms (30°C water probe); the voltage at TP4 should be 0.300 ± .003 VDC.
6. Set the decade box to 7946 ohms and adjust R117 for 0.400 VDC at TP9.
7. Connect the decade box to the tip and sleeve of a phone plug and plug into the patient probe jack.
8. Set the decade box to 7355 ohms (0°C patient probe) and adjust R17 for 0.000 VDC at TP6.
9. Set the decade box to 4005 ohms and adjust R14 for 0.100 VDC at TP6.

10. Set the decade box for 1200 ohms and adjust R17 for 0.400 VDC at TP6.
11. Set the decade box for 1815 ohms; the voltage at TP6 should be 0.300 VDC. If not, repeat Steps 8 through 10.
12. Set the decade box to 1355 ohms; the voltage at TP6 should be 0.370 ± .002 VDC.
13. Press **AUTO CONTROL**; the level at TP9 should be 0.370 ± .002 VDC.
14. Press **MANUAL CONTROL.**
15. Set the Temperature Control Switch to 00.0 and adjust R38 for 0.000 VDC at TP13.
16. Set the Temperature Control Switch to 40.0 and adjust R35 for -0.400 VDC at TP13.
17. Check the following:

Temperature Control Switch	TP-13
20.0	-0.200 ± .002 VDC
25.0	-0.250 ± .002 VDC
25.5	-0.255 ± .002 VDC

18. Press **AUTO CONTROL**; set the decade resistor to 1200 ohms (40°C patient probe); set the Temperature Control Switch to 40.0. Adjust R120 for 0.0 ± .01 VDC at TP7.
19. Press **PATIENT TEMP NO THERAPY**. Adjust R72 for 6.0 ± .05 VDC at TP14.
20. Set the Temperature Control Switch to 24.5. Adjust R85 for -.245 at TP12.
21 Set the Temperature Control Switch to 41.5. Voltage range should be -.412 to -.418 VDC at TP11.
22. Set the decade resistor to 965 ohms (45.5°C patient probe) and adjust R55 for .452V at TP3. The **CHECK PATIENT PROBE** light should be on.
23. Set the Temperature Control Switch to 37.0. Set the decade resistor at 2304 ohms (24.5°C patient probe). Voltage range should be .241 to .249 VDC at TP8. The **CHECK PATIENT PROBE** light should be on.

3.4.3 A1 DISPLAY BOARD (REFER TO FIGURE 6.22 ON PAGE 6-15)

1. Set the decade resistor at 1200 ohms (40°C patient probe) and adjust R51 on the Display Board so that the three digit display indicates 40.0.

Connect a jumper wire across A1P1. Set the decade resistor to 1815 ohms and adjust R76 until the patient temperature displays indicates 86.0. Set the decade resistor to 1200 ohms and adjust R81 until the display indicates 104.0. Repeat these adjustments until decade resistor settings of 1815 and 1200 ohms result in display indications of 86.0 and 104.0 respectively.

2. Remove jumper.
3. Turn power off and connect the decade resistor between pins 9 (red wire) and 15 (blue wire) of A3P1 on the Power Supply Board.
4. Turn power on, set the decade resistor to 7946 ohms (40°C water probe) and adjust R46 on the Display Board until the two digit display indicates 40.

   Connect a jumper across A1P1.

   Set the decade resistor to 56045 ohms and adjust R84 until the **BLANKET** Temperature display indicates 000. Set the decade resistor to 7946 ohms and adjust R73 until the display indicates 104. Recheck the display with the decade resistor set to 56045 ohms and repeat the procedure if necessary.
5. Remove jumper.

3.5 REFRIGERATION CONTROLLER (S4) ADJUSTMENT

The following test equipment is suggested to complete adjustment of the refrigeration controller (S4):

- GAYMAR TPT-9 Tester
- Mercury Thermometer (±1°C accuracy), -2°C to 52°C, Brooklyn Thermometer, Type 73544, Gaymar P/N: TFC-1, or equivalent.
- DBK-5 Connector Hose

A. Check water level and add distilled water if necessary.

B. Connect the test set-up as shown in Figure 6.15, Page 6-10.

C. Adjust Temperature Control Switch to "00".

D. Turn unit on.

E. Note that Refrigeration Controller S4 scales are approximate only. Set temperature **CUT IN** (see Figure 6.15, Page 6-10) at 42°F (6.5° - 5.2°C). Set differential at 5°F. Monitor output water temperature with mercury thermometer. Observe two cycles and readjust if necessary.

F. Test is complete

3.5.1 PRIMARY BACK-UP ADJUSTMENT

Also required, in addition to the equipment required in Section 3.5:

(1) Gaymar Hyper/Hypothermia Pad, Model #DHP-901.

A. Connect unit as shown in Figure 6.12, Page 6-9.

NOTE: **Leave cover assembly (A-700) tipped up.**

B. Turn 120 VAC on.

C. Set Temperature Control Switch to 49°C.

D. Select **MANUAL** mode and allow unit to come to a steady temperature (approximately 30 minutes).

E. Observe the thermometer and note that the temperature cycles up and down; a complete cycle takes approximately one (1) minute. Record the maximum and minimum indications for two (2) consecutive cycles. The average of these four readings should be 41° ± 0.5°C. If not, it will be necessary to adjust the trim pot, R1 on the A3 Power Supply Board. Remove the seal from the potentiometer adjustment screw. Turning the adjustment screw clockwise will lower the water temperature and counter-clockwise rotation will raise the water temperature.

F. If proper calibration cannot be achieved, disconnect J2 and P2 in the MT-4000 base unit. See Figure 6-18, Page 6-11. Set the Temperature Control Switch to 41.0°C, run unit for fifteen (15) minutes (unit will indicate "**IN TEMP ZONE**"), and check the blanket water temperature on the thermometer inserted into TPT-9. If necessary, adjust the Temperature Control Switch for a stable temperature indication of 41°C on the thermometer. Remove RT1 from its location in the heater manifold. Clean off white thermal grease. Remove the thermometer from the TPT-9 and place RT1 into the TPT-9. With an ohmmeter (select a range that drives no more than 0.6 milliamps through the unknown) measure the resistance of RT1 by making contact at the contacts in J2. The value obtained should be 1100 ± 20 ohms. If not, discard RT1 and replace with a new RT1, Gaymar P/N 04910-000.

3.6 FLOW SWITCH CLEANING PROCEDURE

See Figure 6.16, Page 6-10.

4.0 *TROUBLESHOOTING & SERVICE DATA

4.1 This section contains a Troubleshooting Guide to assist the service technician in diagnosing and correcting problems with the Hyper/Hypothermia Unit.

	SYMPTOM	PROBABLE CAUSE	RESOLUTION
1.	**CHECK WATER FLOW.**	Low water level.	Add distilled water.
	(**CHECK WATER FLOW** light on, machine in **MANUAL** or **AUTOMATIC** mode.)	Blanket hoses kinked off.	Eliminate kink.
		Blanket hose pinch clamps are closed.	Unclamp.
		Quick disconnects are not fully engaged, improperly connected or plugged.	Correct. On older units, the quick disconnects may be hard to operate. See Symptom 8 of this section.
		Blocked or stuck solenoid valves.	Disassemble solenoid and eliminate the obstruction.
		Pump not running.	Measure the voltage between terminals 7 and 8 of TB1 with the machine turned on. (Machine can be in either **MANUAL** or **AUTO** mode.) If it is 120 VAC, replace the pump. If the voltage is 0, repair or replace the top cover.
		Clogged flow switch.	Refer to Figure 6.16 on Page 6-10 for cleaning instructions.

* **ALWAYS PERFORM FUNCTIONAL CHECKOUT/INSPECTION (PAGE 3-4, SECTION 3.3) PRIOR TO TROUBLESHOOTING UNIT.**

	SYMPTOM	PROBABLE CAUSE	RESOLUTION
2.	**CHECK WATER FLOW** Indicator Does Not Light.	Burned out bulb.	Press **TEST LIGHTS** switch. If light does not light, replace bulb.
	(When quick disconnect supply line is disconnected and unit is turned on.)	Clogged flow switch.	If **CHECK WATER FLOW** light lights when Test Switch is pressed but will not turn on when a blanket connector is removed, the Flow Switch should be removed and cleaned (Figure 6.16, Page 6-10). Test switch contact opening and closing before reinstalling.
		A1 Control Board defective.	Repair or replace control Board.
3.	Blanket Will Not Cool (Temperature Control Switch set at 00 and unit in **MANUAL** mode.)	S4 Refrigeration controller is defective.	Jumper contacts of S4. If unit cools down, replace S4. If not, S4 is okay. See Figure 6.13, Page 6-9 for jumper locations only.
		Defective solenoid.	When **COOL** light is lit, check for 120 VAC at terminals #3 and #5 on TB1. If voltage is present, repair or replace solenoid. If 0 volts, replace top cover.
		Dirty or restricted refrigeration condenser.	Insure that side air-exchange grill work is not restricted at operating location. Insure condenser fan is free to rotate and is not binding. Insure condenser unit is free of lint and dust buildup.
		Refrigeration unit has lost its charge.	Recharge refrigeration system according to Section 4.2.1, Paragraph "Y". Be sure to check for Freon leaks.

SYMPTOM	PROBABLE CAUSE	RESOLUTION
	Faulty refrigeration unit.	Audibly confirm compressor operation. Do not confuse with the motor fan noise. If not, running, the compressor unit starter relay, the thermal overload unit or the capacitor is faulty and must be replaced. See Figure 6.9, Page 6-6.
4. Blanket Will Not Cool in the Correct Range 5° ± 1°C.	Refrigeration controller (S4) out of calibration.	Calibrate. See Section 3.5.
	Faulty cooling system.	See Symptom #3.
5. Blanket Will Not Heat in any Mode (Set Temperature Control Switch at 40°C).	Faulty top cover or temperature probe assembly.	Remove wrap around. Set Temperature Control Switch at 40°C. **HEAT** light should be on. 120 VAC should be present between terminals #8 and #10 of TB1. If voltage is 0, the top cover or the Temperature Probe Assembly is defective and must be replaced or Repaired.
	Defective solenoid.	When the **HEAT** light is lit, check for 120 VAC between terminals #4 and #5 on TB1. If voltage is present, repair or replace the solenoid. If voltage is 0, replace the top cover.
	Faulty heater or S3 thermostat.	Set Temperature Control Switch to 40°C. **HEAT** light should be on. With wrap around removed, verify current flow to the heater (through temperature limiting thermostat). If open circuit exists, thermostat must be replaced. If open circuits persist, the heater assembly is defective and must be replaced.
	Cold solenoid (K1) not properly closed.	Heater and thermostats check out okay. Disassemble and clean (K1) Cold Solenoid and Plunger.
	Primary Back-Up high temperature controller is out of calibration.	See Section 3.3.1, Paragraph "M".

	SYMPTOM	PROBABLE CAUSE	RESOLUTION
6.	**MACHINE SHUT-DOWN REMOVE FROM SERVICE** light is on. (When machine was previously **OFF** for more than 2 hours.)	S1 or S2 thermostats are damaged or defective.	Short out terminals 8 and 9 at TB1 (Figure 6.18, page 6-11). Start Machine. (1) if "**MACHINE SHUT-DOWN REMOVE FROM SERVICE**" light goes out, S1 or S2 is defective (open). Find open thermostat and replace. Check calibration after replacement. (2) If "**MACHINE SHUT-DOWN REMOVE FROM SERVICE**" light stays on, defect is on the Power Supply Board.
7.	**MACHINE SHUT-DOWN REMOVE FROM SERVICE**light is on. (When machine has been operating for approximately 30 minutes.)	Primary Temperature Control is out of calibration.	Check calibration per Section 3.3.1, Paragraph "M".
		S2 Thermostat out of calibration.	Check calibration per Section 3.3.1, Paragraph "I". If faulty, repair or replace.
		S2 Thermostat out of calibration.	Check per Section 3.3.1, Paragraph "N". If faulty, repair or replace.
		Power Board is defective.	Repair or replace.
		S4 refrigeration controller is out of calibration.	Check calibration per Section 3.3.1, Paragraph "O". If faulty, repair or replace.
8.	Quick Disconnects on Unit Hard to Operate.	If machine is not used regularly, the metal quick disconnect fittings on the unit may become stiff and difficult to engage.	Problem can be eliminated by applying a silicone-base or light machine oil to the inside of the blanket connector.

	SYMPTOM	PROBABLE CAUSE	RESOLUTION
9.	High Current Leakage (Frost on suction line).	Excessive Freon charge.	Recharge to specifications in Section 4.2.1, Paragraph "Y".
		Defective heater.	Disconnect heater and measure again. Replace heater if necessary.
10.	No Lights on Front Panel. (Circuit breaker is on and **TEST LIGHTS** button is depressed.)	Faulty transformer (T1).	Measure input voltage to transformer at A3J2 plug (see Figure 6.24, Page 6-17), pins 5 and 6. Voltage should be 120 VAC. Measure output voltage of transformer at A3J2 plug, pins 2 and 3. This should be 24 VAC. If not, replace the transformer.
11.	**PATIENT** Temperature Display reads approximately 19° - 20°C.	Defective Probe or Adaptor.	Replace probe or adaptor.
12.	Operator complains blanket water is too cold in **AUTOMATIC** mode.	No defect. Operator doesn't understand **AUTOMATIC** mode operation.	Explain **AUTOMATIC** mode or seek assistance from your sales representative.

4.2 REPAIR PROCEDURES

4.2.1 RECHARGING REFRIGERATION UNIT

The following procedures detail leak checking, evacuation and recharging of the refrigeration unit. Completion of these procedures requires the following special tools and/or test equipment:

- Refrigeration Test Gauge Assembly
- Freon 12 Tank or Charging Cylinder
- Halogen Leak Detector
- Dry Nitrogen Charging Cylinder

For further clarification refer to proper test equipment configuration shown in Figure 6.17, Page 6-11.

A. Remove large valve stem caps from service valves and turn both valve stems counterclockwise until they stop.

B. Remove small side cap from gauge port fitting on each service valve.

C. Turn lower service valve stem slowly clockwise and allow gas to escape until almost empty, then turn valve stem counterclockwise.

D. Loosely connect hoses from refrigeration test gauge assembly to gauge port fittings of each service valve.

> NOTE: **Lower service valve is the pressure (high) side, and the upper service valve on the compressor is the suction (low) side.**

E. Open both valves on refrigeration test gauge assembly.

F. Connect center hose from the refrigeration test gauge assembly to Freon 12 tank with its valve up or to top valve of a Freon 12 charging cylinder.

G. Open Freon supply valve and allow the gas to purge air from both test gauge hoses while tightening hose nuts on gauge port fitting of each valve.

H. Turn both service valve stems clockwise to open and allow the Freon to pressurize the unit to 45 psi, then close Freon supply valve.

I. Close both valves on refrigeration test gauge assembly, remove center hose from Freon gas supply, and connect immediately to dry nitrogen tank through pressure control valve.

NOTE: **Insure nitrogen pressure regulator handle is turned counterclockwise.**

J. Open both valves on refrigeration test gauge assembly.

K. Open nitrogen tank valve and turn nitrogen pressure regulator handle clockwise until gauge reads 150 psi.

L. Close both valves on refrigeration test gauge assembly and close nitrogen tank valve.

M. Turn nitrogen pressure regulator handle fully counterclockwise and disconnect hose from nitrogen supply.

N. Check all tubing and valve joints in the system with a halogen leak detector and repair any refrigerant leaks after puring pressure.

O. Make certain that all pressure is purged from the system before proceeding.

P. Connect center hose from refrigeration test gauge assembly to vacuum pump and open both test gauge valves approximately two turns.

Q. Allow the vacuum pump to run until the low pressure gauge reads 27 or more in. Hg. vacuum for 15 minutes; then shut off vacuum pump.

R. Turn both service valve stems counterclockwise and reconnect center hose to Freon tank with valve up or to top valve of charging cylinder.

S. Loosen hose nut at center connector on manifold; open Freon supply valve; purge hose until liquid appears; then tighten hose nut.

T. Turn suction service valve stem clockwise two turns and allow Freon to build up to tank pressure by opening suction gauge valve on manifold.

U. **CLOSE LEFT SIDE VALVE ON REFRIGERATION TEST GAUGE ASSEMBLY TIGHTLY.**

V. Insure water level is correct.

W. Connect DBK-5 hose on unit between one supply and one return fitting.

X. Set Temperature Control Switch to "00". Turn unit on and press **MANUAL** mode.

Y. To add Freon while unit is running, make sure both service valve stems are turned clockwise about two turns. With Freon supply valve open, open left-hand gauge valve and observe pressures. Close left-hand gauge valve when suction pressure gauge reads 30 psi. When the temperature of the water in the reservoir reaches 40°F (4.4° to 4.5°C), the proper suction pressure should be 22-25 psi. The proper high side pressure is 125-150 psi. Add or purge Freon as necessary to obtain proper readings with the suction pressure being the critical reading for proper performance, approximately 16 ounces of Freon 12 is the correct charge.

Z. Turn unit off.

AA. Perform leak test and repeat leak test with unit running.

BB. Allow unit to run until compressor cycles off; then check **BLANKET WATER** temperature display to insure refrigeration controller cycles the compressor between 3.9° and 6.5°C.

CC. Turn unit off and allow suction and high side pressures to equalize. Close both service valves and Freon supply valve.

DD. Disconnect hoses.

EE. Replace caps on both service valve gauge ports and valve stems immediately. Make sure packing nuts on valve stems are tight. Tighten caps sufficiently to prevent leakage.

4.2.2 REPLACING A3 POWER SUPPLY BOARD

The following procedures describe replacement of the A3 Power Supply Board. A Digital Voltmeter is required.

A. After replacing the board in the cover, reconnect all connectors to the A3 board, except the connector from the A2 Control board to the Power Supply Board.

B. Turn unit on.

C. Measure the following voltages at connector A3P3 (see page 6-17).

DVM Common to Pin	DVM + Lead to Pin	Voltage Reading
8	5	-12 ± 0.5V
8	6	- 5 ± 0.2V
8	9	+ 12 ± 0.5V
8	10	+ 5 ± 0.2V

See page 6-17 for pin number 8 location.

D. Turn unit off.

E. Connect the power supply board to the control board.

F. Perform the following operational checks from Section 3.3 of the Preventive Maintenance Procedures.

Check Out No.	Description
G	Condition of lights, alarm and temperature indicators.
J	Flow switch activation.
L	Second high temperature back-up thermostat (S2).
M	Primary high sensor temperature

4.2.3 REPLACING THE A2 CONTROL BOARD

A. It is not necessary to calibrate the control board since it comes set from the factory.

B. After installing the Control Board, perform the checkout from Section 3.3 of the Preventive Maintenance Procedure.

Check Out No.	Description
G	Condition of lights, alarm and temperature indicators.
P	Blanket water temperature controller and display.

4.2.4 REPLACING THE A1 DISPLAY BOARD

A. It is not necessary to calibrate the display board since it comes set from the factory.

B. After installing the display board, perform the checkout from Section 3.3 of the Preventive Maintenance Procedure.

Check Out No.	Description
G	Condition of lights, alarm and temperature indicators.
P	Blanket water temperature controller and display.

4.2.5 THERMOSTATS

After thermostats have been replaced,t he appropriate checkout should be performed. These are detailed in Section 3.3 of the Preventive Maintenance Procedures as outlined below:

Control Thermostat	Check #	Description
S1	N	Low temperature back-up thermostat (S1).
S2	L	Second high temperature back-up thermostat (S2).
S3	K	Third back-up thermostat (S3).
S4*	O	Refrigeration controller (S4)

*** When replacing S4, it is also necessary to calibrate the S4 according th Section 3.5 before performing the checkout.**

4.2.6 TOP COVER

If a complete new cover from Gaymar is being installed, adjustments may be needed. See Section 3.5.1.

A. Turn unit off.

B. Remove old top cover from unit by removing 4 screws underneath top cover and disconnecting cable. See Figure 6.18, Page 6-11.

C. Install new top cover.

D. Connect the test set-up shown in Figure 6.12 on Page 6-9.

E. Set the Temperature Control Switch to 49°C. Turn unit on. Set in **MANUAL** mode.

F. The average water temperature on the mercury thermometer should stabilize at 41° ± 0.5°C.

G. If unit does not stabilize, see Primary Back-up Adjustment, Section 3.5.1.

4.3 SPARE PARTS

The following pages contain a Spare Parts List to aid you with any repair that may be needed on your Medi-Therm machine.

Illustrations which correspond with the items below are located in Figure 6.20, Page 6-13 and Figure 6.21, Page 6-14.

ITEM	DESCRIPTION	PART NUMBER	MTA-4700
1	Compressor, Altered	77368-000	x
	A. Capacitor Start	77637-000	x
	B. Relay	77638-000	x
	C. Thermal Overload	77639-000	x
2	Thermostat, Orange Dot (S2)	77369-000	x
3	Thermostat, Blue Dot (S3)	77370-000	x
4	Temperature Probe Assembly (RT2/RT3)	77371-000	x
5	Thermostat (S1)	77372-000	x
6	Circuit Breaker (CB1)	77373-000	x
7	Solenoid Valve K1 and K2	77640-000	x
8	Temperature Probe Assembly (RT1)	77374-000	x
10	Solenoid Valve Kit	77624-000	x
12	Quick Disconnect (Female) 1/8 NPT	77376-000	x
13	Flow Switch, Altered	77377-000	x
14	Pump Altered (M1)	77378-000	x
	A. Pump Housing	77379-000	x
	B. O-Ring, 2-3/4" ID	77380-000	x
	C. Pump Housing Cover	77381-000	x
	D. O-Ring	77382-000	x
	E. Impeller Spindle	77383-000	x
	F. Impeller Magnet Assembly	77384-000	x

ITEM	DESCRIPTION	PART NUMBER	MTA-4700
15	Controller (S4)	77633-000	x
16	Filter Dryer Assembly	77386-000	x
17	Caster, R.H.	77387-000	x
18	Caster, L.H.	77388-000	x
19	Rack	77625-000	x
20	Strain Relief	77390-000	x
21	Power Cord	77391-000	x
22	Strap *(not shown)*	77634-000	x
23	Wrap Around *(not shown)*	77392-000	x
23	Heater Assembly (HR-1)	77393-000	x
24	Card 1: Start Up Instructions	77626-000	x
	Card 2: Auto Patient Control	77627-000	x
	Card 3: Patient Temperature Monitor	77628-000	x
25	Alarm Switch Assembly and °C/°F Switch	77399-000	x
26	Clamp	77400-000	x
27	Transformer Assembly	77401-000	x
29	Power Supply Board	77402-000	x
30	Main Control Board	77629-000	x
31	Display Board	77630-000	x
32	Control Panel Assembly	77631-000	x
33	Temperature Control Switch Assembly	77632-000	x
36	Rear Label, Nameplate	77407-000	x
37	Cover, Push Wheel	77635-000	x

Please remember, repairs should only be performed by a qualified bio-medical technician, familiar with repair practices for servicing medical devices.

GAYMAR TEST TOOLS REFERRED TO THROUGHOUT THIS MANUAL

TPT-9 Tester

Shorting Plug, P/N 77352-000

DBK-5 Blanket Connecting Hose

Substitute Precision Resistor Kit PRK-2

Test Connector P/N 05559-000

Models TA-700 and TMT-4000

TFC-1 Mercury Thermometer (±1°C accuracy) -2° to 52°C
(or use standard Brooklyn Thermometer, Type 73544, or equivalent.)

Dedicated test tool assemblies are available for independent testing of top and base. Consult Gaymar Industries, Technical Service Department for details.

4.4 SHIPPING/REPACKAGING INSTRUCTIONS

See Figure 6.25, Page 6-18 for drawing and complete repackaging instructions for shipping the Medi-Therm back to Gaymar or to a qualified Service Center. If you do not have the original packing materials, please contact Gaymar Technical Service and a complete Customer Return Kit will be sent to you. Be sure to contact our Technical Service Department before shipping for "Return Authorization".

4.4 SHIPPING/REPACKAGING INSTRUCTIONS

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5.0 REFERENCE TABLES

5.1 Celsius-to-Fahrenheit Conversion Table

°C	°F
0	32
0.5	32.9
1	33.8
1.5	34.7
2	35.6
2.5	36.5
3	37.4
3.5	38.3
4	39.2
4.5	40.1
5	41
5.5	41.9
6	42.8
6.5	43.7
7	44.6
7.5	45.5
8	46.4
8.5	47.3
9	48.2
9.5	49.1
10	50
10.5	50.9
11	51.8
11.5	52.7
12	53.6
12.5	54.5
13	55.4
13.5	56.3
14	57.2
14.5	58.1
15	59
15.5	59.9
16	60.8
16.5	61.7
17	62.6
17.5	63.5
18	64.4
18.5	65.3
19	66.2
19.5	67.1
20	68
20.5	68.9
21	69.8
21.5	70.7
22	71.6
22.5	72.5

°C	°F
23	73.4
23.5	74.3
24	75.2
24.5	76.1
25	77.0
25.5	77.9
26	78.8
26.5	79.7
27	80.6
27.5	81.5
28	82.4
28.5	83.3
29	84.2
29.5	85.1
30	86
30.5	86.9
31	87.8
31.5	88.7
32	89.6
32.5	90.5
33	91.4
33.5	92.3
34	93.2
34.5	94.1
35	95
35.5	95.9
36	96.8
36.5	97.7
37	98.6
37.5	99.5
38	100.4
38.5	101.3
39	102.2
39.5	103.1
40	104
40.5	104.5
41	105.8
41.5	106.7
42	107.6
42.5	108.5
43	109.4
43.5	110.3
44	111.2
44.5	112.1
45	113

5.2 REFERENCE TABLES

The following charts are for assistance in substituting resistance values for temperatures.

5.2.1 Patient Probe

Temperature	-vs-	Resistance
°C	°F	Ohms
+ 20	68	2814
21	69.8	2690
22	71.6	2572
23	73.4	2460
24	75.2	2354
25	77	2252
26	78.8	2156
27	80.6	2064
28	82.4	1977
29	84.2	1894
30	86	1815
31	87.8	1739
32	89.6	1667
33	91.4	1599
34	93.2	1533
35	95	1471
36	96.8	1412
37	98.6	1355
38	100.4	1301
39	102.2	1249
40	104	1200
41	105.8	1152
42	107.6	1107
43	109.4	1064
44	111.2	1023
45	113	983.8

5.2.2 Primary Back-up Thermistor (RT1)

Temperature -vs-	Resistance
°C	Ohms
+ 10	3660
15	2940
20	2460
25	2000
30	1660
35	1380
37.8	1240
40	1140
41	1100
45	950
50	820
55	680
60	580

5.2.3 Water Probe (RT2)

Temperature -vs-	Resistance
°C	Ohms
+ 0	19.59K
1	18.62K
2	17.70K
3	16.83K
4	16.01K
5	15.24K
6	14.50K
7	13.81K
8	13.15K
9	12.53K
10	11.94K
11	11.38K
12	10.85K
13	10.35K
14	9878
15	9428
16	9000
17	8594
18	8210
19	7844
20	7496
21	7166
22	6852
23	6554
24	6270
25	6000
26	5744
27	5500
28	5266
29	5046
30	4834
31	4634
32	4442
33	4260
34	4084
35	3918
36	3760
37	3610
38	3466
39	3328
40	3196
41	3070
42	2950
43	2836
44	2726
45	2620
46	2520
47	2424
48	2334
49	2246
50	2162

5.2.4 Water Probe (RT3)

Temperature -vs- Resistance	
°C	Ohms
+ 0	94.98K
1	90.41K
2	86.09K
3	81.99K
4	78.11K
5	74.44K
6	70.96K
7	67.66K
8	64.53K
9	61.56K
10	58.75K
11	56.07K
12	53.54K
13	51.13K
14	48.84K
15	46.67K
16	44.60K
17	42.64K
18	40.77K
19	38.99K
20	37.30K
21	35.70K
22	34.17K
23	32.71K
24	31.32K
25	30.00K
26	28.74K
27	27.54K
28	26.40K
29	25.31K
30	24.27K
31	23.28K
32	22.33K
33	21.43K
34	20.57K
35	19.74K
36	18.96K
37	18.21K
38	17.49K
39	16.80K
40	16.15K
41	15.52K
42	14.92K
43	14.35K
44	13.80K
45	13.28K
46	12.77K
47	12.29K
48	11.83K
49	11.39K
50	10.97K

FIG. 6.1 WARM-UP RATE (with full size Gaymar Blanket)

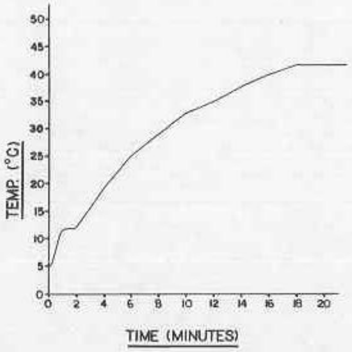


FIG. 6.2 COOL DOWN RATE (with full-size Gaymar Blanket) AFTER INITIAL START-UP.

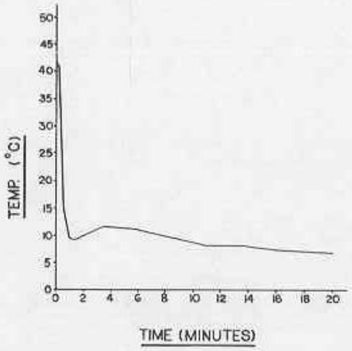
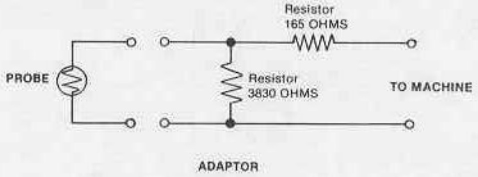


FIG. 6.3 ADP-10B CIRCUIT DIAGRAM


Resistor
165 OHMS
PROBE
Resistor
3830 OHMS
TO MACHINE
ADAPTOR

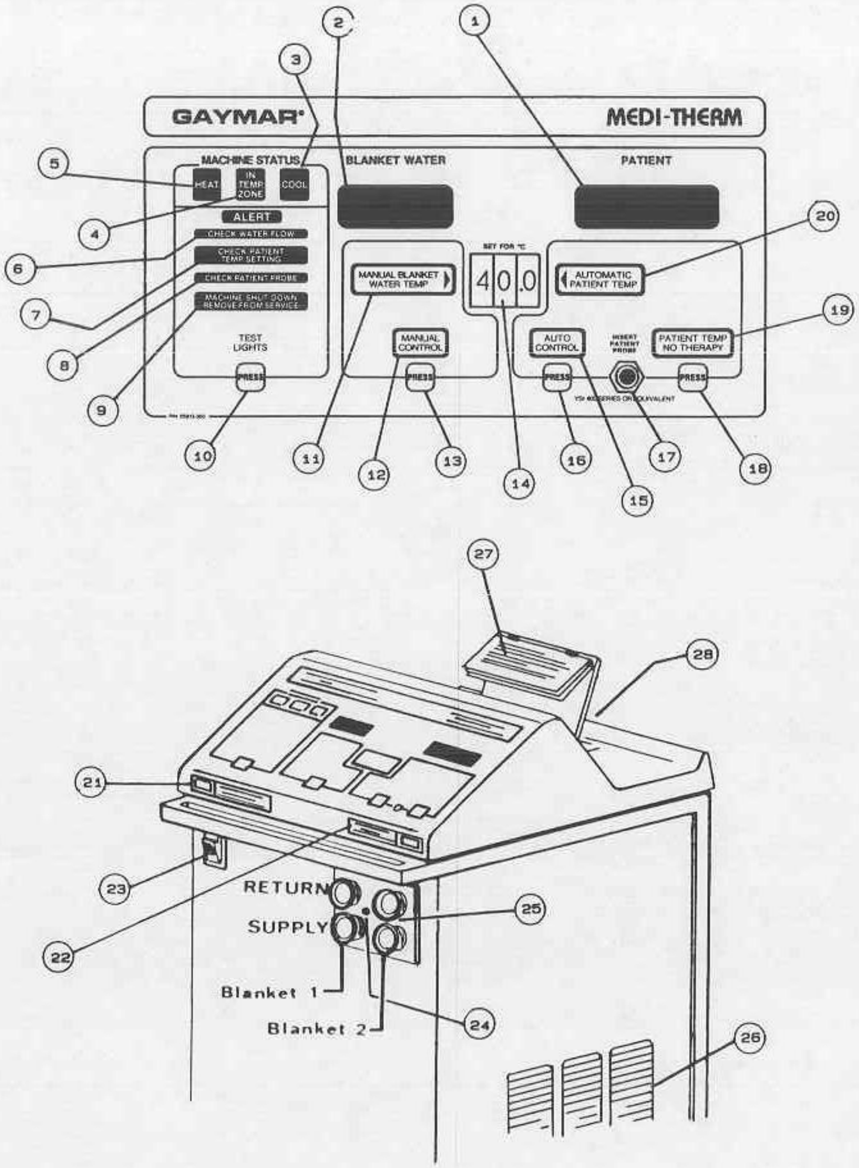

GAYMAR
MEDI-THERM
MACHINE STATUS
HEAT
IN TEMP ZONE
COOL
BLANKET WATER
PATIENT
ALERT
CHECK WATER FLOW
CHECK PATIENT TEMP SETTING
CHECK PATIENT PROBE
MACHINE SHUT DOWN REMOVE FROM SERVICE
TEST LIGHTS
PRESS
MANUAL BLANKET WATER TEMP
SET FOR °C
40.0
AUTOMATIC PATIENT TEMP
MANUAL CONTROL
AUTO CONTROL
INSERT PATIENT PROBE
PATIENT TEMP NO THERAPY
YSI 400 SERIES OR EQUIVALENT
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
RETURN
SUPPLY
Blanket 1
Blanket 2

FIG. 6.4

HEATING : WHEN THE MEDITHERM UNIT IS IN THE HEATING MODE, WATER FLOWS IN THE PATH SHOWN BELOW.

NOTE: K1: COLD SOLENOID VALVE
K2: HOT SOLENOID VALVE

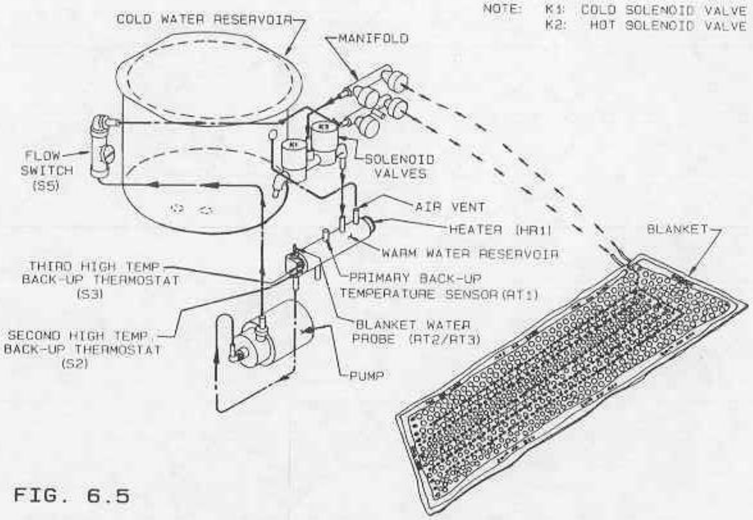

COLD WATER RESERVOIR
MANIFOLD
FLOW SWITCH (S5)
SOLENOID VALVES
AIR VENT
HEATER (HR1)
WARM WATER RESERVOIR
BLANKET
THIRD HIGH TEMP BACK-UP THERMOSTAT (S3)
PRIMARY BACK-UP TEMPERATURE SENSOR (RT1)
SECOND HIGH TEMP BACK-UP THERMOSTAT (S2)
BLANKET WATER PROBE (RT2/RT3)
PUMP

FIG. 6.5

COOLING : WHEN THE MEDITHERM UNIT IS IN THE COOLING MODE, WATER FLOWS IN THE PATH SHOWN BELOW.

NOTE: K1: COLD SOLENOID VALVE
K2: HOT SOLENOID VALVE

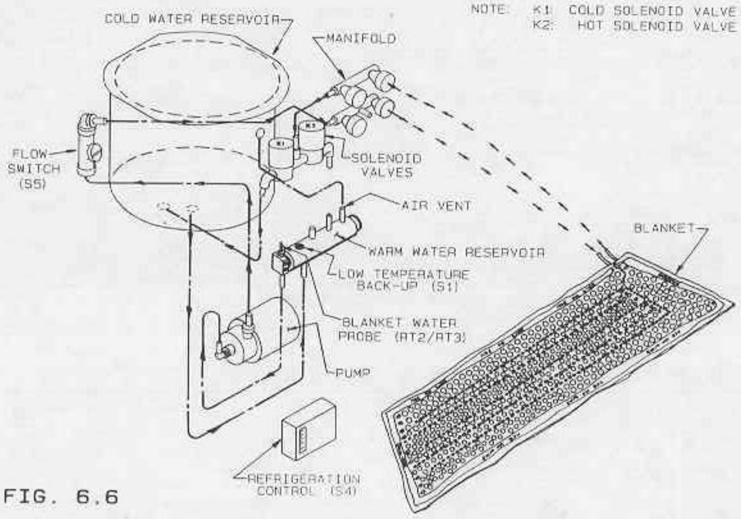

COLD WATER RESERVOIR
MANIFOLD
FLOW SWITCH (S5)
SOLENOID VALVES
AIR VENT
BLANKET
WARM WATER RESERVOIR
LOW TEMPERATURE BACK-UP (S1)
BLANKET WATER PROBE (RT2/RT3)
PUMP
REFRIGERATION CONTROL (S4)

FIG. 6.6

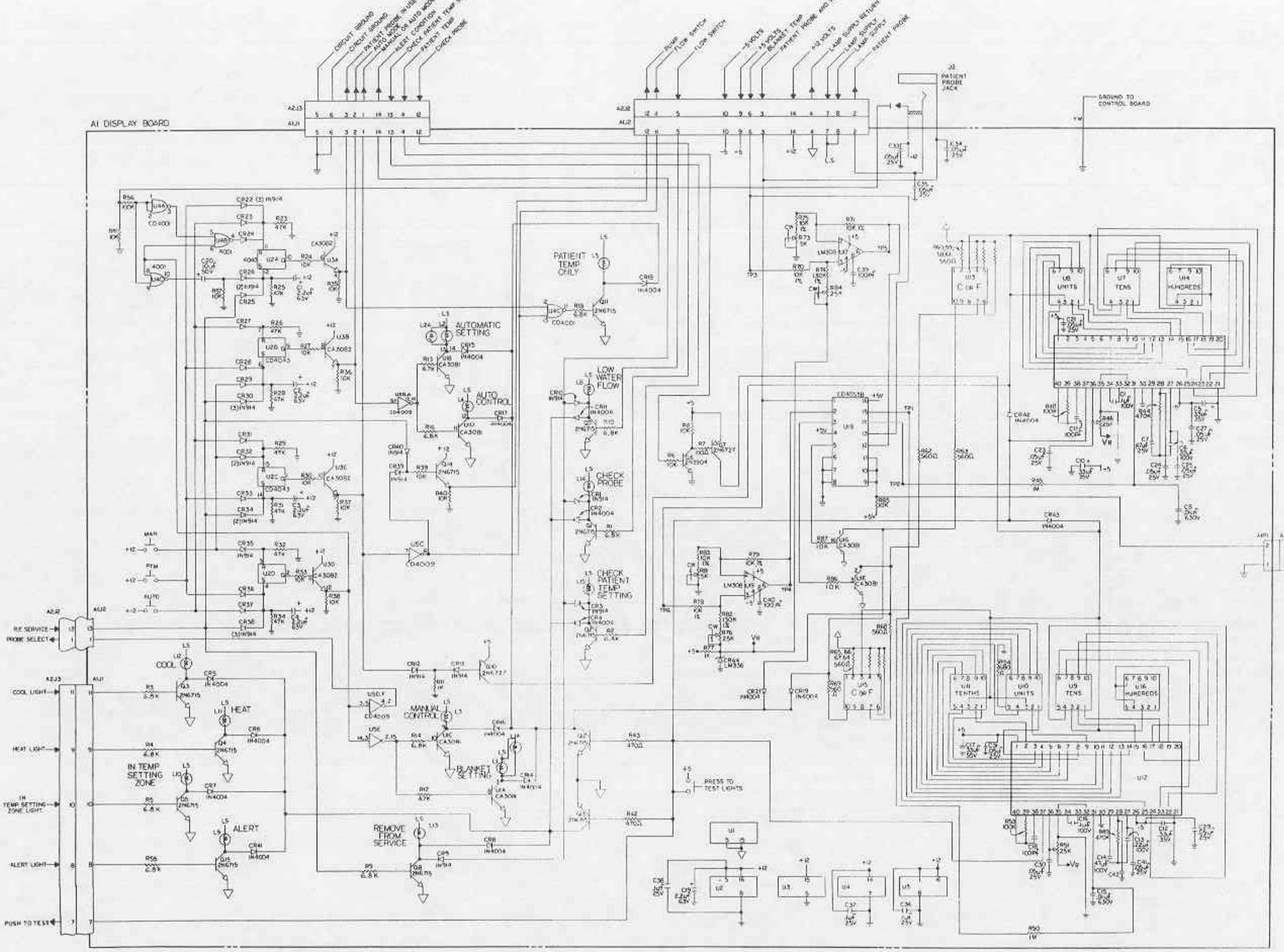

CIRCUIT GROUND
CIRCUIT GROUND
PATIENT PROBE IN USE
AUTO MODE
MANUAL OR AUTO MODE
ALERT CONDITION
CHECK PATIENT TEMP SETTING
PATIENT TEMP
CHECK PROBE
PUMP
FLOW SWITCH
FLOW SWITCH
-5 VOLTS
+5 VOLTS
BLANKET TEMP
PATIENT PROBE AND TEMP
+12 VOLTS
LAMP SUPPLY RETURN
LAMP SUPPLY
LAMP SUPPLY
PATIENT PROBE
J2 PATIENT PROBE JACK
GROUND TO CONTROL BOARD
A2J3
A1J1
A2J2
A1J2
A1 DISPLAY BOARD
PATIENT TEMP ONLY
AUTOMATIC SETTING
AUTO CONTROL
LOW WATER FLOW
CHECK PROBE
CHECK PATIENT TEMP SETTING
MAN
PTM
AUTO
P.E. SERVICE
PROBE SELECT
COOL
HEAT
IN TEMP SETTING ZONE
ALERT
REMOVE FROM SERVICE
MANUAL CONTROL
BLANKET SETTING
PRESS TO TEST LIGHTS
COOL LIGHT
HEAT LIGHT
IN TEMP SETTING ZONE LIGHT
ALERT LIGHT
PUSH TO TEST
U8 UNITS
U7 TENS
U14 HUNDREDS
U13 C or F
U11 TENTHS
U10 UNITS
U9 TENS
U16 HUNDREDS
U15 C or F
U12
U19
CD4001
CD4043
CD4009
CA3082
CA3081
LM308
LM336
2N6715
1N4004
1N914

FIG. 6.7 ELECTRICAL SCHEMATIC - A1 DISPLAY BOARD

NOTES

ALL RESISTORS ARE ±5% TOLERANCE UNLESS OTHERWISE INDICATED

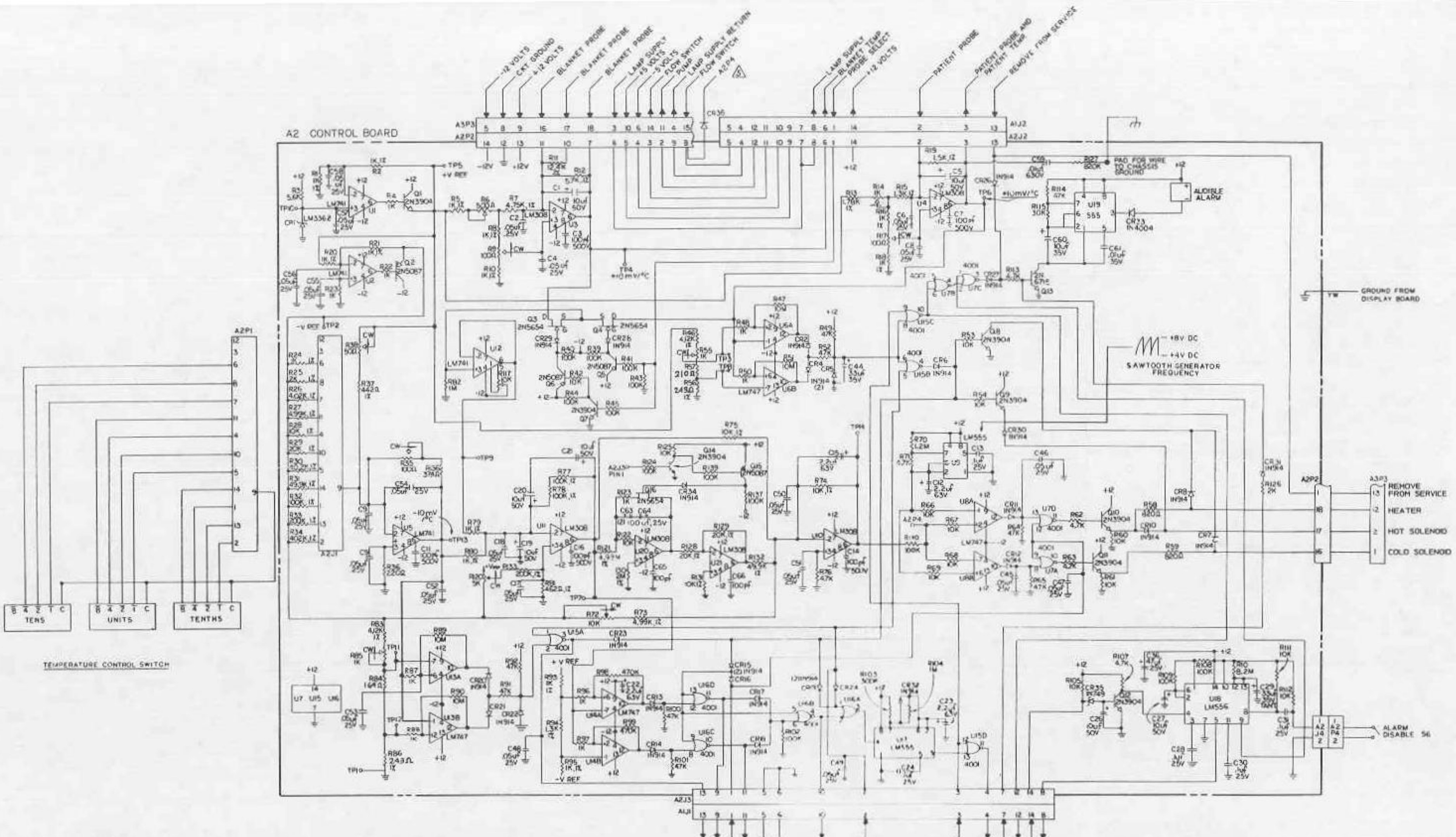
⏚ CIRCUIT GROUND

⏚ CHASSIS GROUND

⏚ LAMP GROUND

HIGHEST DESIGNATION USED

COMPONENT	QUAN
R	87
C	42
CR	44
U	19
TP	6
Q	15


A2 CONTROL BOARD
A3P3
A2P2
-12 VOLTS
CKT GROUND
+12 VOLTS
BLANKET PROBE
BLANKET PROBE
BLANKET PROBE
LAMP SUPPLY
+5 VOLTS
-5 VOLTS
FLOW SWITCH
PUMP
LAMP SUPPLY RETURN
FLOW SWITCH
A2P4
CR36
LAMP SUPPLY
BLANKET TEMP
PROBE SELECT
+12 VOLTS
PATIENT PROBE
PATIENT PROBE AND PATIENT TEMP
REMOVE FROM SERVICE
A1J2
A2J2
PAD FOR WIRE TO CHASSIS GROUND
AUDIBLE ALARM
SAWTOOTH GENERATOR FREQUENCY
+8V DC
+4V DC
GROUND FROM DISPLAY BOARD
REMOVE FROM SERVICE
HEATER
HOT SOLENOID
COLD SOLENOID
ALARM DISABLE S6
A2P1
A2J1
TENS
UNITS
TENTHS
TEMPERATURE CONTROL SWITCH
A2J3
A1J1
CHK PAT TEMP SETTING
HEAT LIGHT
MANUAL OR AUTO MODE
COOL LIGHT
CKT GROUND
CKT GROUND
TEMP SETTING ZONE LIGHT
PUSH TO TEST
CHECK PROBE
ALERT CONDITION
ALERT LIGHT

NOTES

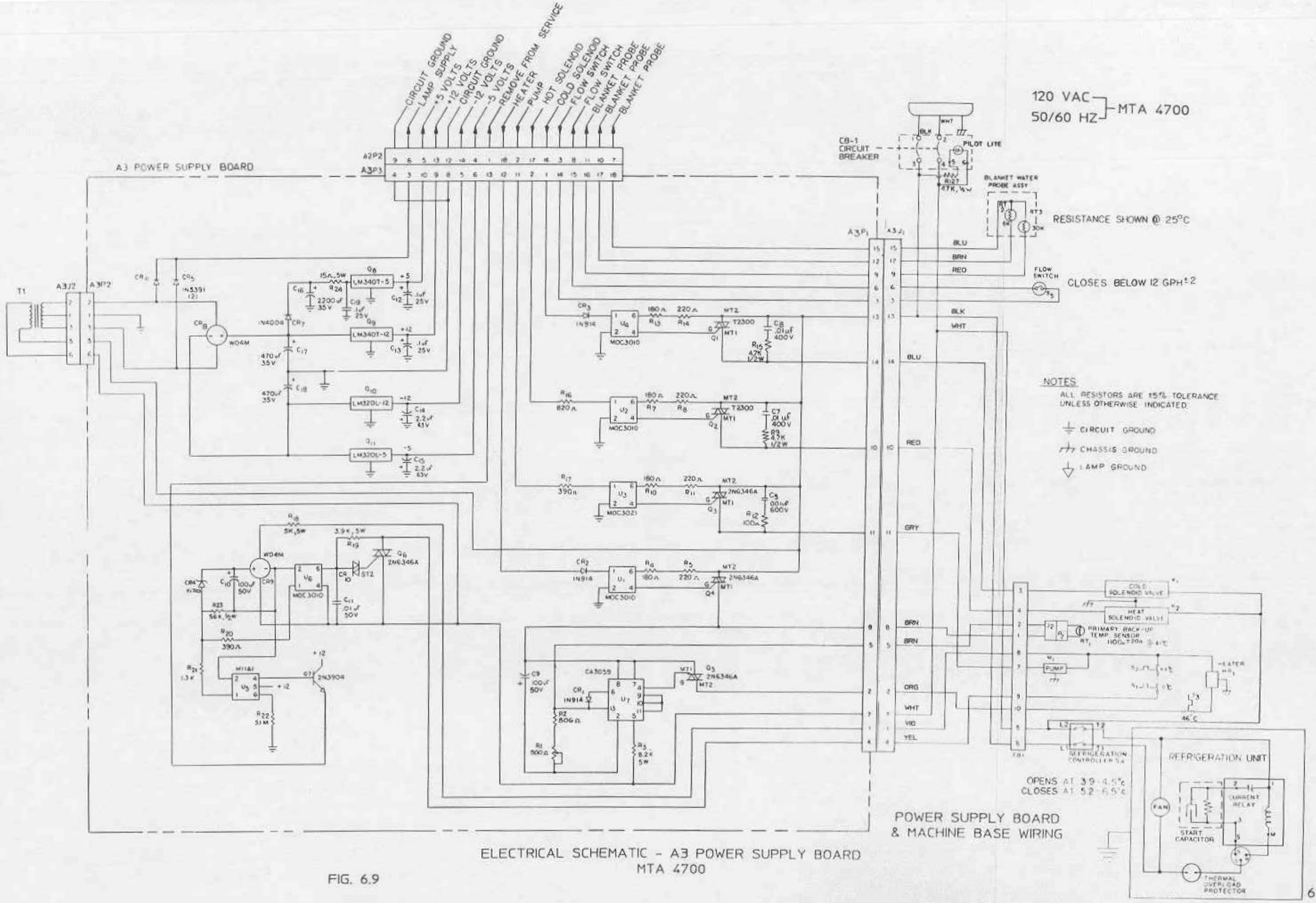
1. ALL RESISTORS ARE ±5% TOLERANCE UNLESS OTHERWISE INDICATED
2. ⏚ CIRCUIT GROUND
3. ⏚ CHASSIS GROUND
4. ⏚ LAMP GROUND
5. ADDITIONAL WIRE TO BE USED ON WHC MODELS ONLY

HIGHEST DESIGNATION NO. USED

COMPONENTS	QUAN
R	140
C	66
CR	36
U	21
TP	14
Q	16

ELECTRICAL SCHEMATIC - A2 MAIN CONTROL BOARD

FIG. 6.8


CIRCUIT GROUND
LAMP SUPPLY
+5 VOLTS
+12 VOLTS
CIRCUIT GROUND
-12 VOLTS
-5 VOLTS
REMOVE FROM SERVICE
HEATER
PUMP
HOT SOLENOID
COLD SOLENOID
FLOW SWITCH
FLOW SWITCH
BLANKET PROBE
BLANKET PROBE
BLANKET PROBE
A2P2
A3P3
A3 POWER SUPPLY BOARD
T1
A3J2
A3P2
CR11
CR5
1N5391 (2)
CR8
W04M
1N4004
CR7
C16
2200 uF 35V
15Ω, 5W
R24
C19
.1uF 25V
Q8
LM340T-5
+5
C12
.1uF 25V
Q9
LM340T-12
+12
C13
.1uF 25V
470uF 35V
C17
470uF 35V
C18
Q10
LM320L-12
-12
C14
2.2uF 63V
Q11
LM320L-5
-5
C15
2.2uF 63V
CR3
1N914
U4
MOC3010
180Ω
R13
220Ω
R14
MT2
T2300
G
Q1
MT1
C8
.01uF 400V
R15
47K
1/2W
R16
820Ω
U2
MOC3010
180Ω
R7
220Ω
R8
MT2
T2300
G
MT1
Q2
C7
.01uF 400V
R9
4.7K
1/2W
R17
390Ω
U3
MOC3021
180Ω
R10
220Ω
R11
MT2
2N6346A
G
MT1
Q3
C5
.001uF 600V
R12
100Ω
CR2
1N914
U1
MOC3010
R4
180Ω
R5
220Ω
MT2
2N6346A
G
MT1
Q4
R18
5K, 5W
3.9K, 5W
R19
W04M
CR9
Q6
2N6346A
CR4
C10
100uF 50V
U6
MOC3010
CR10
ST2
C11
.01uF 50V
R23
56K, 1/2W
R20
390Ω
R21
1.3K
H11A1
U5
+12
+12
Q7
2N3904
R22
5.1M
C9
100uF 50V
CA3059
CR1
1N914
U7
R2
806Ω
R1
500Ω
R3
8.2K
5W
Q5
2N6346A
MT1
MT2
G
CB-1
CIRCUIT
BREAKER
BLK
WHT
PILOT LITE
R127
47K, 1/4W
BLANKET WATER
PROBE ASSY
RT2
6K
RT3
30K
A3P1
A3J1
BLU
BRN
RED
FLOW
SWITCH
S5
BLK
WHT
BLU
RED
GRY
BRN
BRN
ORG
WHT
VIO
YEL
COLD
SOLENOID VALVE
HEAT
SOLENOID VALVE
PRIMARY BACK-UP
TEMP SENSOR
RT1
PUMP
M1
HEATER
HR1
46°C
L2
T2
L1
T1
REFRIGERATION
CONTROLLER
TB1
REFRIGERATION UNIT
FAN
START
CAPACITOR
CURRENT
RELAY
THERMAL
OVERLOAD
PROTECTOR

120 VAC
50/60 HZ – MTA 4700

RESISTANCE SHOWN @ 25°C

CLOSES BELOW 12 GPH±2

NOTES

ALL RESISTORS ARE ±5% TOLERANCE UNLESS OTHERWISE INDICATED.

⏚ CIRCUIT GROUND

CHASSIS GROUND

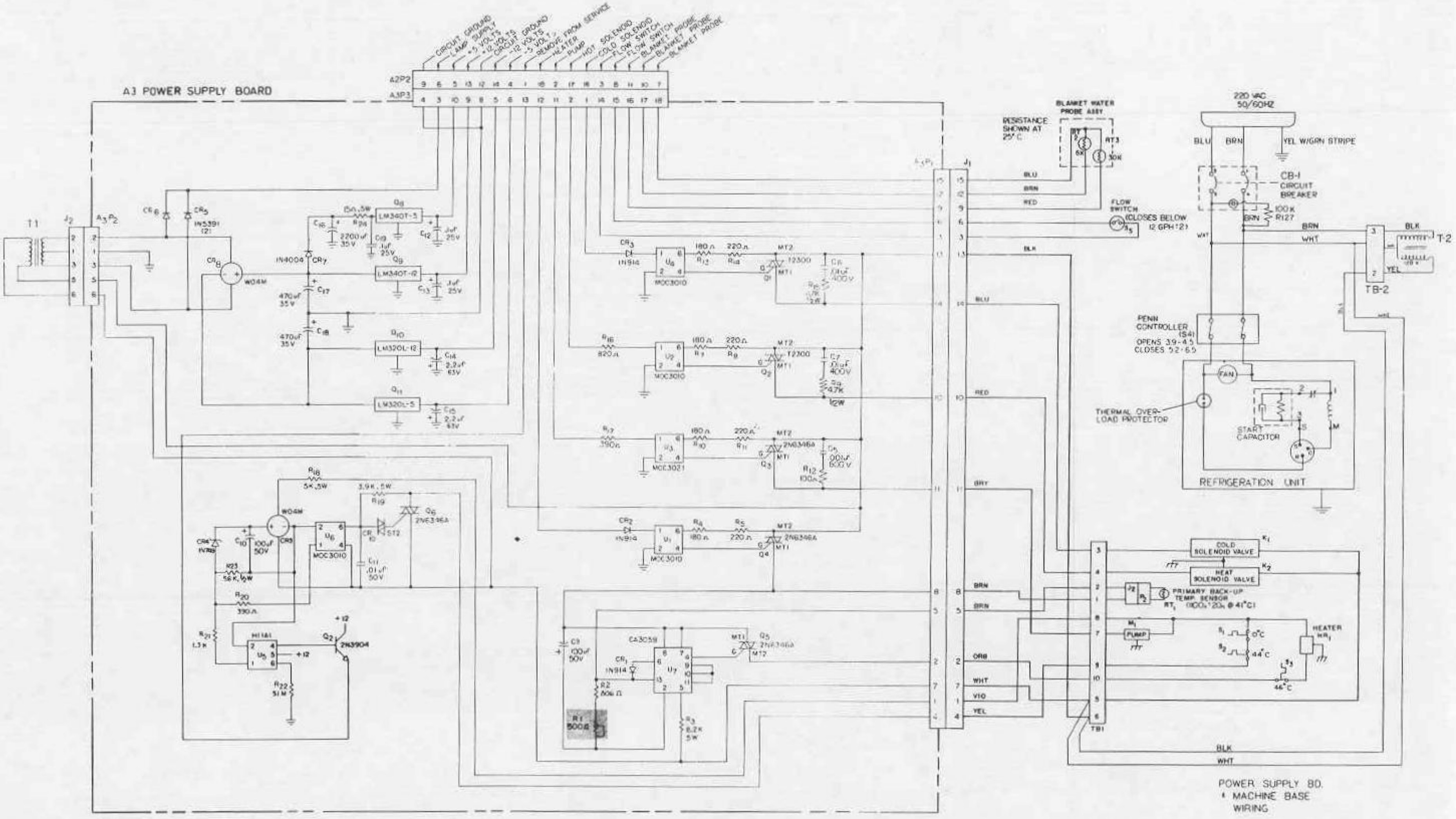
LAMP GROUND

OPENS AT 3.9-4.5°c
CLOSES AT 5.2-6.5°c

POWER SUPPLY BOARD
& MACHINE BASE WIRING

ELECTRICAL SCHEMATIC - A3 POWER SUPPLY BOARD
MTA 4700

FIG. 6.9


A3 POWER SUPPLY BOARD
A2P2
A3P3
CIRCUIT GROUND
LAMP SUPPLY
+5 VOLTS
+12 VOLTS
CIRCUIT GROUND
-12 VOLTS
-5 VOLTS
REMOVE FROM SERVICE
HEATER
PUMP
HOT SOLENOID
COLD SOLENOID
FLOW SWITCH
FLOW SWITCH
BLANKET PROBE
BLANKET PROBE
BLANKET PROBE
T1
J2
A3P2
CR6
CR5
1N5391
CR8
W04M
1N4004
CR7
Q8
LM340T-5
Q9
LM340T-12
Q10
LM320L-12
Q11
LM320L-5
CR3
1N914
U8
MOC3010
U2
MOC3010
U3
MOC3021
U1
MOC3010
2N6346A
T2300
MT2
MT1
R18
5K .5W
3.9K .5W
R19
Q6
2N6346A
U6
MOC3010
CR4
R23
56K, 1/2W
R20
390Ω
R21
1.3K
H11A1
U5
Q7
2N3904
R22
51M
CA3059
U7
CR1
1N914
R2
806Ω
R1
500Ω
Q5
2N6346A
R3
8.2K
5W
C3
100μF
50V
A3P1
J1
BLU
BRN
RED
BLK
GRY
ORG
WHT
VIO
YEL
RESISTANCE SHOWN AT 25°C
BLANKET WATER PROBE ASSY
RT2
RT3
5K
30K
FLOW SWITCH
(CLOSES BELOW 12 GPH)(2)
S5
220 VAC 50/60HZ
YEL W/GRN STRIPE
CB-1
CIRCUIT BREAKER
100K
R127
T-2
TB-2
PENN CONTROLLER (S4)
OPENS 3.9-4.5
CLOSES 5.2-6.5
FAN
THERMAL OVER-LOAD PROTECTOR
START CAPACITOR
M
REFRIGERATION UNIT
COLD SOLENOID VALVE
K1
HEAT SOLENOID VALVE
K2
PRIMARY BACK-UP TEMP. SENSOR
RT1 (100Ω ±20Ω @ 41°C)
M1
PUMP
S1
0°C
S2
44°C
LS3
46°C
HEATER
HR1
TB1
POWER SUPPLY BD. & MACHINE BASE WIRING

NOTES
ALL RESISTORS ARE ±5% TOLERANCE UNLESS OTHERWISE INDICATED

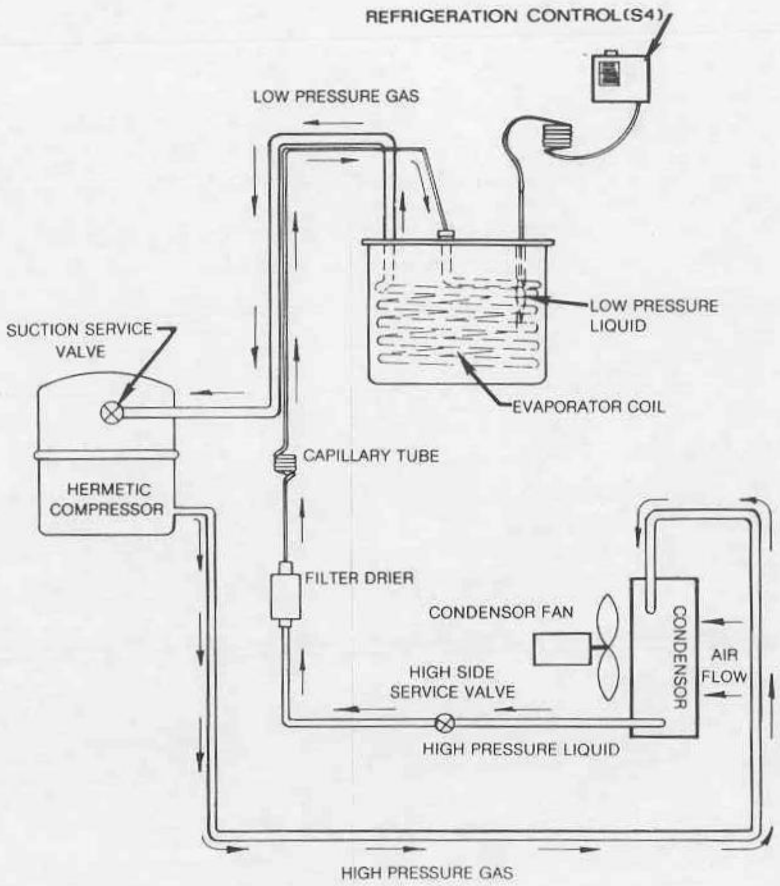
- ⏚ CIRCUIT GROUND
- ⏚ CHASSIS GROUND
- ⏚ LAMP GROUND

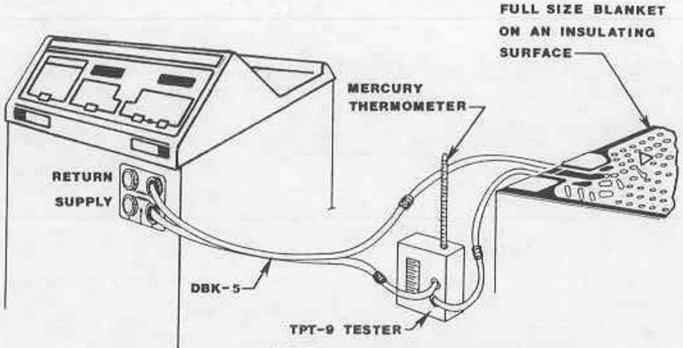
ELECTRICAL SCHEMATIC - A3 POWER SUPPLY BOARD

MTA4702

FIG. 6.10

FIG. 6.11 REFRIGERATION FLOW DIAGRAM


REFRIGERATION CONTROL(S4)
LOW PRESSURE GAS
LOW PRESSURE LIQUID
SUCTION SERVICE VALVE
EVAPORATOR COIL
CAPILLARY TUBE
HERMETIC COMPRESSOR
FILTER DRIER
CONDENSOR FAN
CONDENSOR
AIR FLOW
HIGH SIDE SERVICE VALVE
HIGH PRESSURE LIQUID
HIGH PRESSURE GAS


FULL SIZE BLANKET
ON AN INSULATING
SURFACE
MERCURY
THERMOMETER
RETURN
SUPPLY
DBK-5
TPT-9 TESTER

(MUST ALWAYS BE INSTALLED IN SUPPLY LINE BEFORE PAD. DO NOT INSTALL TESTER IN RETURN LINE.)

FIG. 6.12

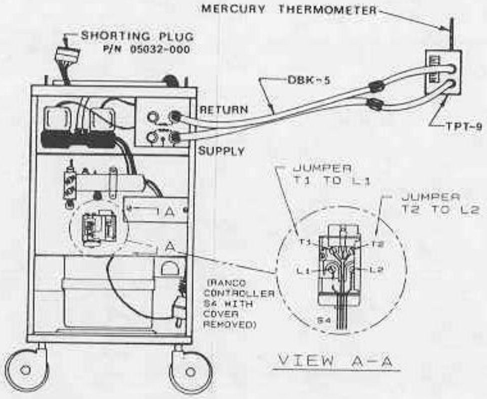

MERCURY THERMOMETER
SHORTING PLUG
P/N 05032-000
DBK-5
RETURN
SUPPLY
TPT-9
JUMPER
T1 TO L1
JUMPER
T2 TO L2
A
A
T1
T2
L1
L2
S4
(RANCO
CONTROLLER
S4 WITH
COVER
REMOVED)
VIEW A-A

FIG. 6.13

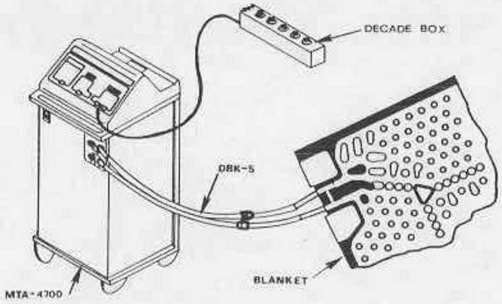

DECADE BOX
DBK-5
BLANKET
MTA-4700

FIG. 6.14

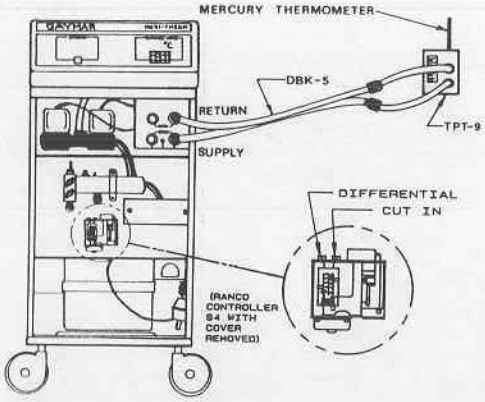

MERCURY THERMOMETER
GAYMAR
°C
DBK-5
RETURN
SUPPLY
TPT-9
DIFFERENTIAL
CUT IN
(RANCO CONTROLLER S4 WITH COVER REMOVED)

FIG. 6.15

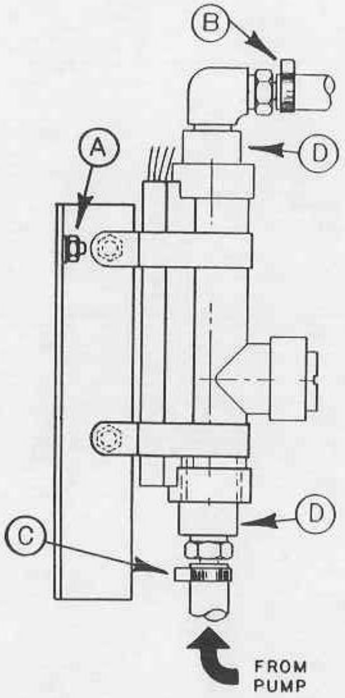

B
A
D
C
D
FROM PUMP

FIG. 6.16

FLOW SWITCH CLEANING PROCEDURE

a) REMOVE NUT (ITEM A) AND REMOVE ASSEMBLY.

b) LOOSEN HOSE CLAMP (ITEM B) AND REMOVE HOSE.

c) LOOSEN HOSE CLAMP (ITEM C) AND REMOVE HOSE.

d) REMOVE 1/8 NPT ADAPTORS (ITEM D) . REMOVE PLUNGER.

e) CLEAN ALL PARTS WITH ALCOHOL AND REMOVE ANY FOREIGN MATTER.

f) TO REASSEMBLE, REVERSE STEPS "a" THROUGH "d".

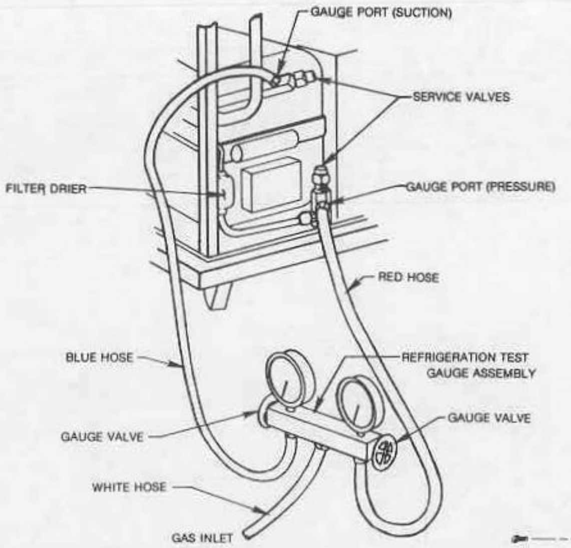
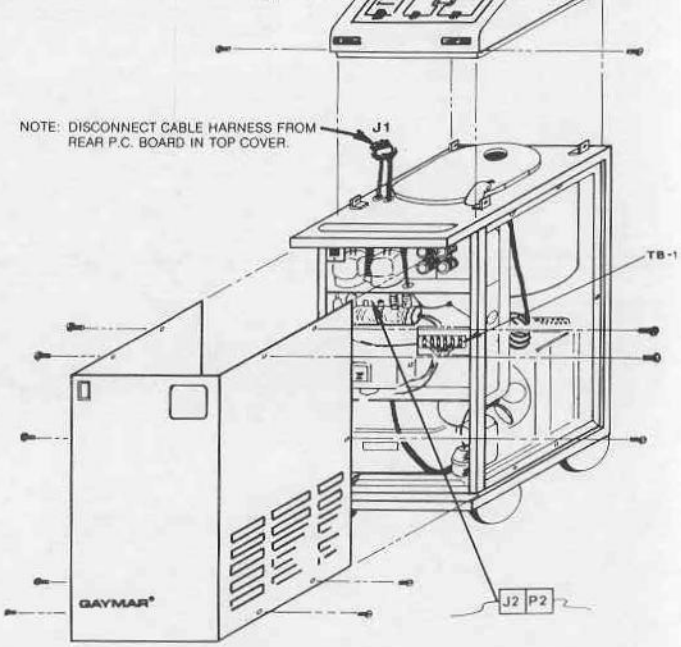

GAUGE PORT (SUCTION)
SERVICE VALVES
FILTER DRIER
GAUGE PORT (PRESSURE)
RED HOSE
BLUE HOSE
REFRIGERATION TEST GAUGE ASSEMBLY
GAUGE VALVE
GAUGE VALVE
WHITE HOSE
GAS INLET

FIG. 6.17


J1
TB-1
GAYMAR®
J2
P2

NOTE: DISCONNECT CABLE HARNESS FROM REAR P.C. BOARD IN TOP COVER.

FIG. 6.18

P.C. BOARD CONNECTIONS

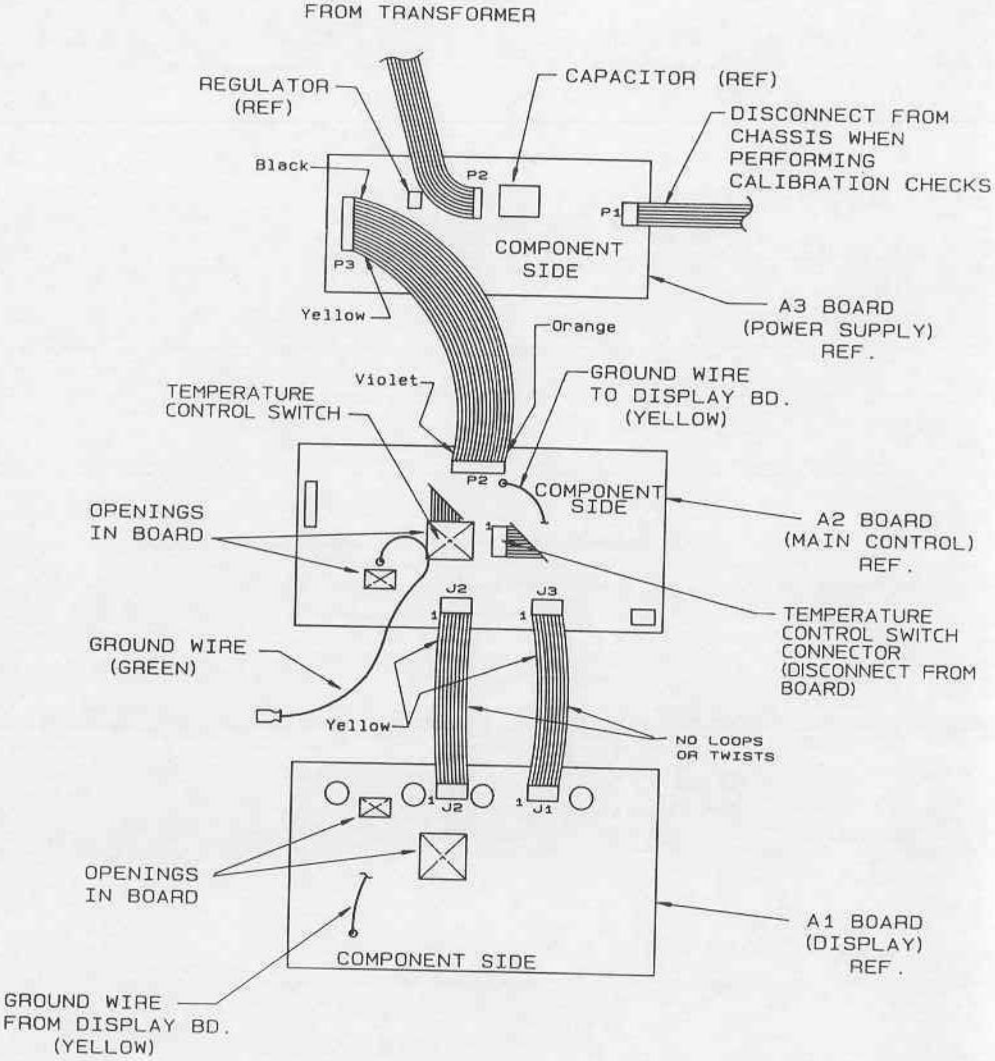

FROM TRANSFORMER
REGULATOR (REF)
CAPACITOR (REF)
DISCONNECT FROM CHASSIS WHEN PERFORMING CALIBRATION CHECKS
Black
P2
P1
P3
COMPONENT SIDE
Yellow
A3 BOARD (POWER SUPPLY) REF.
Orange
Violet
GROUND WIRE TO DISPLAY BD. (YELLOW)
TEMPERATURE CONTROL SWITCH
P2
COMPONENT SIDE
OPENINGS IN BOARD
A2 BOARD (MAIN CONTROL) REF.
J2
J3
1
1
1
TEMPERATURE CONTROL SWITCH CONNECTOR (DISCONNECT FROM BOARD)
GROUND WIRE (GREEN)
Yellow
NO LOOPS OR TWISTS
1
J2
1
J1
OPENINGS IN BOARD
A1 BOARD (DISPLAY) REF.
COMPONENT SIDE
GROUND WIRE FROM DISPLAY BD. (YELLOW)

FIG. 6-19

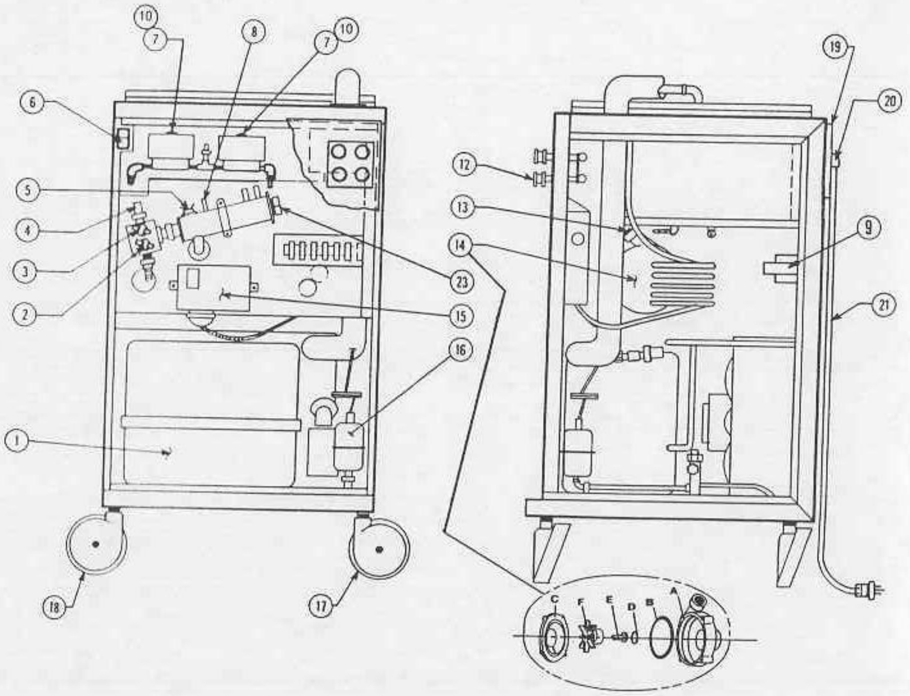

10
7
8
7
10
6
5
4
3
2
23
15
16
1
18
17
19
20
12
13
14
9
21
C
F
E
D
B
A

FIG. 6.20

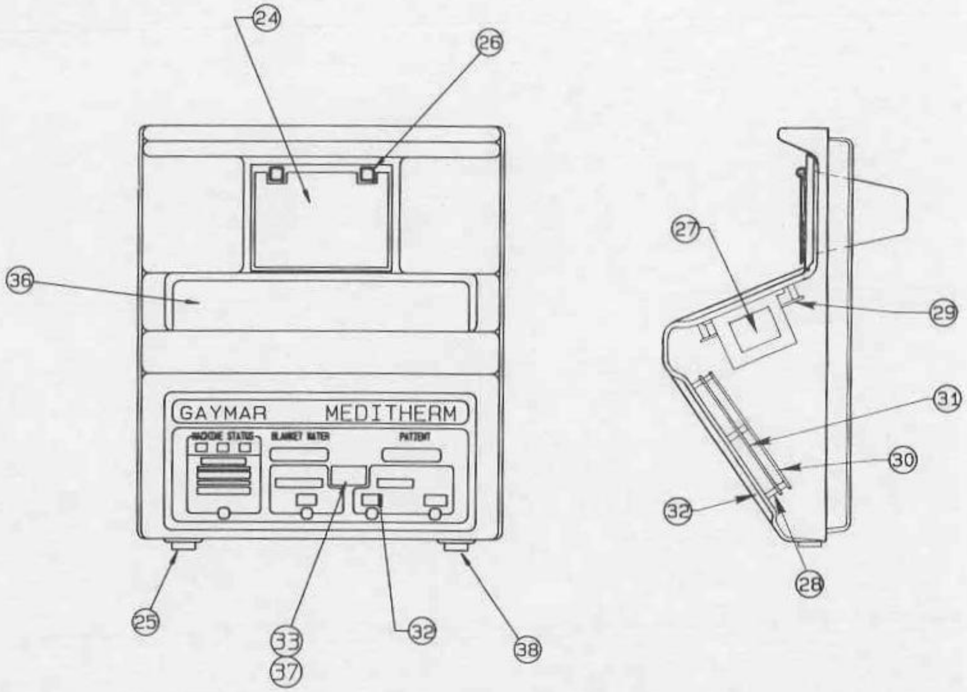

GAYMAR
MEDITHERM
MACHINE STATUS
BLANKET WATER
PATIENT

FIG. 6.21

GROUND LEAD TO CONTROL BOARD

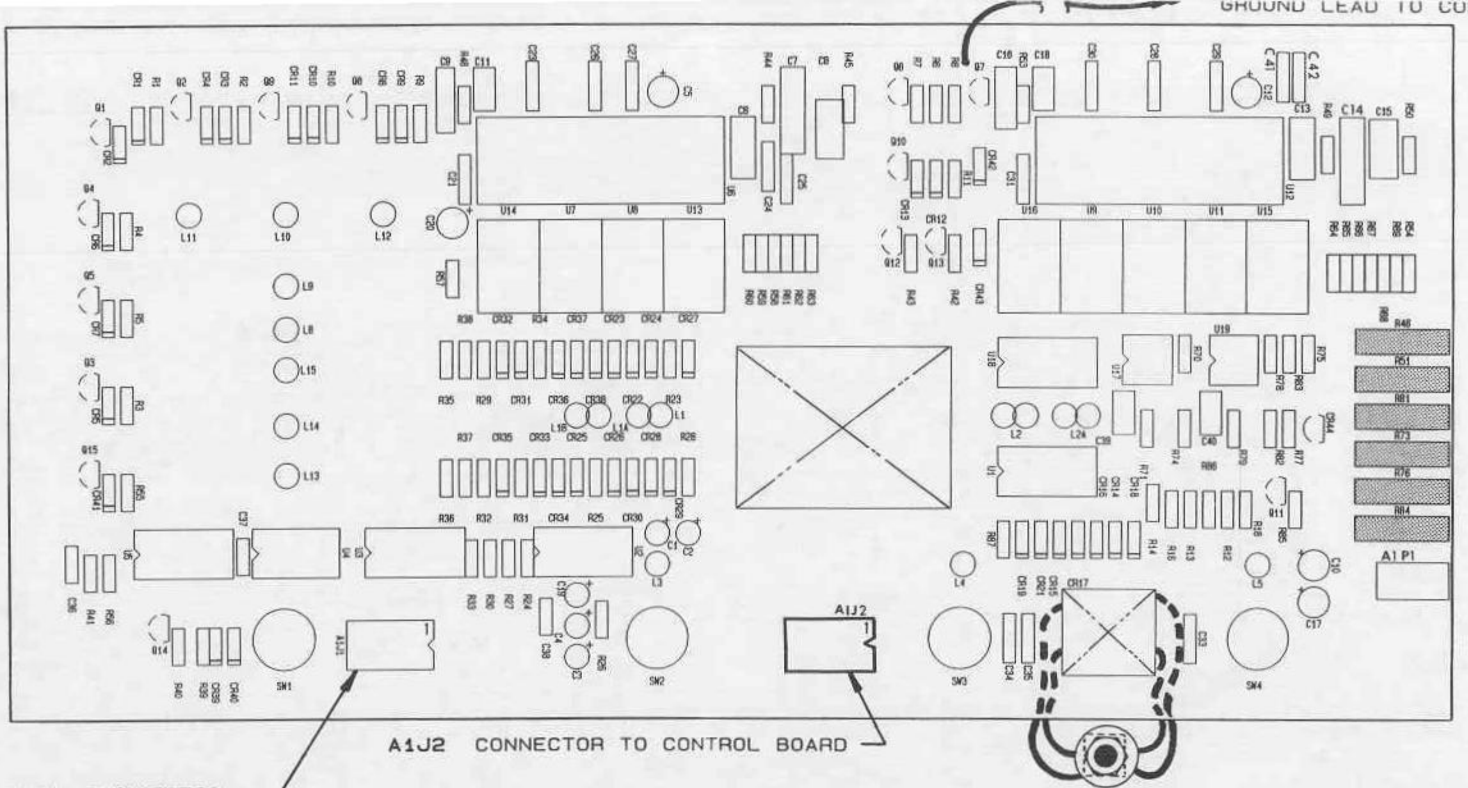


FIG. 6.22

A1J2 CONNECTOR TO CONTROL BOARD

A1J1 CONNECTOR TO CONTROL BOARD

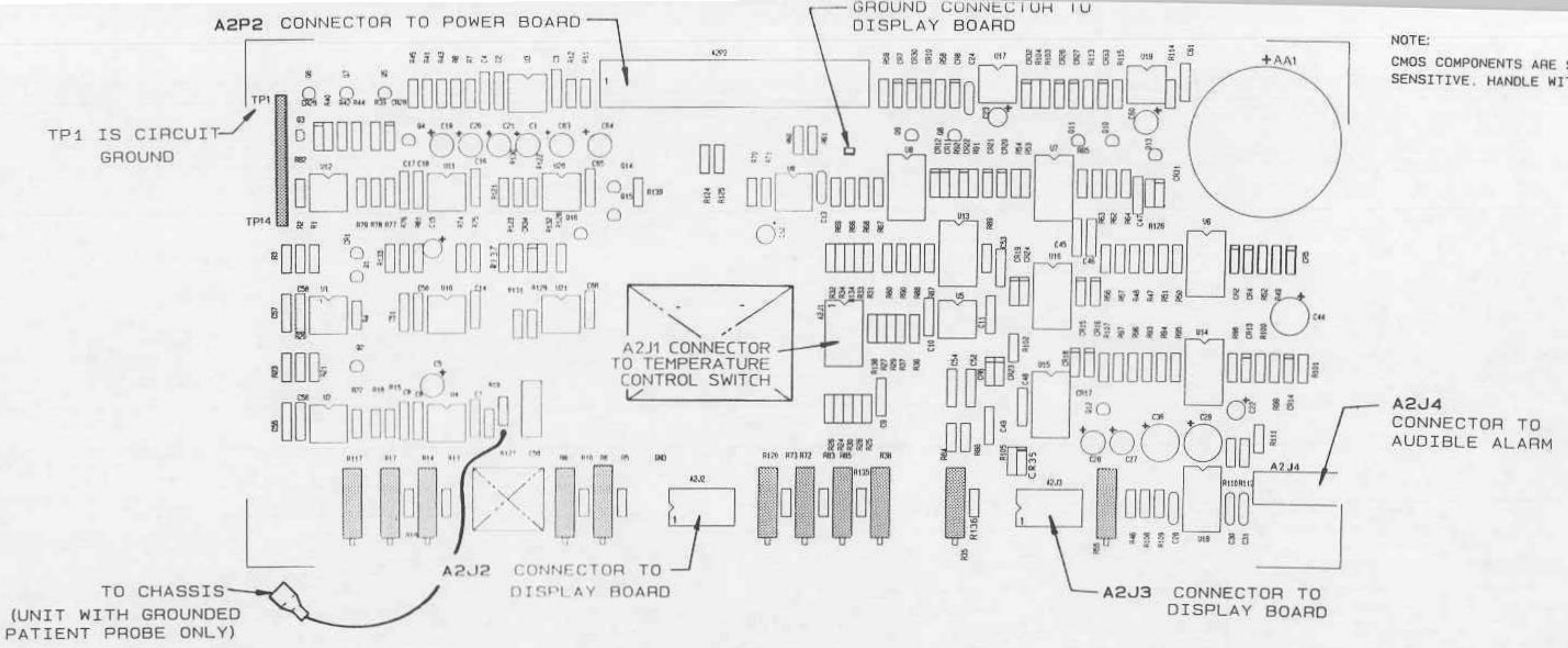
A1 DISPLAY BOARD - SPARE PARTS

GAYMAR P/N	DESIGNATOR	DESCRIPTION
90092-025	R7	RESISTOR 100 OHM, 5%, 1/4W
90092-073	R6, R8, R24, R27 R30, R33, R35-R41 R85, R86, R87	RESISTOR 10K, 5%, 1/4W
90092-049	R11, R77	RESISTOR 1K, 5%, 1/4W
90092-065	R12, R13	RESISTOR 4.7K, 5%, 1/4W
90092-069	R1-R5, R9, R10 R14, R16, R18, R55	RESISTOR 6.8K, 5%, 1/4W
90092-089	R23, R25, R26, R28 R29, R31, R32, R34	RESISTOR 47K, 5%, 1/4W
90092-113	R44, R49	RESISTOR 470K, 5%, 1/4W
90092-121	R45, R50	RESISTOR 1M, 5%, 1/4W
90092-097	R48, R53, R56, R57	RESISTOR 100K, 5%, 1/4W
90092-043	R54, R58-R69	RESISTOR 560 OHM, 5%, 1/4W
90092-041	R42, R43	RESISTOR 470 OHM, 5%, 1/4W
90708-033	R74, R82	RESISTOR 130K, 1%, 1/4W
90708-010	R70, R71, R75, R78 R79, R83	RESISTOR 10K, 1%, 1/4W
90703-000	CI, C2, C3, C4, C19	CAPACITOR 2.2uf/63V

GAYMAR P/N	DESIGNATOR	DESCRIPTION
90707-000	C5, C10, C12, C17	CAPACITOR 33uf/35V
90741-004	C6, C13	CAPACITOR .22uf/100V
90741-003	C7, C14	CAPACITOR .47uf/100V
90741-002	C8, C15	CAPACITOR .01uf/630V
90741-001	C9, C16	CAPACITOR .1uf/100V
90702-000	C11, C18, C39, C40	CAPACITOR 100pf/500V
90701-004	C36, C37, C38	CAPACITOR .1uf/25V
90700-000	C20	CAPACITOR 10uf/50V
90701-001	C21, C23, C24, C25 C27, C29, C30, C31 C33, C34, C35, C41 C42	CAPACITOR .05uf/25V
90456-000	CR1, CR3, CR9 CR10, CR12, CR13, CR22-CR40	DIODE IN914
90730-000	CR44	DIODE LM336Z
90727-000	CR2, CR4-CR8, CR11 CR14-CR19, CR21 CR41, CR42, CR43	DIODE IN4004

GAYMAR P/N	DESIGNATOR	DESCRIPTION
90737-001	Q1-Q5, Q8, Q9 Q11-Q15	TRANSISTOR 2N6715
90714-000	Q6	TRANSISTOR 2N3904
90737-002	Q7, Q10	TRANSISTOR 2N6727
90742-004	U2	INTEGRATED CIRCUIT CD4043
90742-001	U1	INTEGRATED CIRCUIT CA3081
90488-000	U4	INTEGRATED CIRCUIT CD4001
90742-002	U3	INTEGRATED CIRCUIT CA3082
90742-003	U5	INTEGRATED CIRCUIT CA4009
90743-000	U6, U12	INTEGRATED CIRCUIT ICL7107CPL
90742-005	U18	INTEGRATED CIRCUIT CD4053B
90733-003	U17, U19	INTEGRATED CIRCUIT LM308
90761-000	U7-U11, U13-U16	LED LN516RA
90728-006	R46, R51, R76, R84	TRIM POT 25K 15 TURN CERMET
90728-008	R73, R81	TRIM POT 5K 15 TURN CERMET
77146-000	L1, L1A, L2, L2A L3, L4, L5, L8-L15	LITES OSHINO #0L382BRP
90897-000	SW1, SW2, SW3, SW4	SWITCH, WILD ROVER TC/C

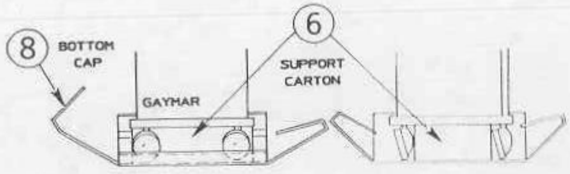
NOTE: CMOS COMPONENTS ARE STATIC SENSITIVE. HANDLE WITH CAUTION.


A2P2 CONNECTOR TO POWER BOARD
GROUND CONNECTOR TO DISPLAY BOARD
TP1 IS CIRCUIT GROUND
TP1
TP14
+AA1
A2J1 CONNECTOR TO TEMPERATURE CONTROL SWITCH
A2J4 CONNECTOR TO AUDIBLE ALARM
A2J2 CONNECTOR TO DISPLAY BOARD
A2J3 CONNECTOR TO DISPLAY BOARD
TO CHASSIS (UNIT WITH GROUNDED PATIENT PROBE ONLY)

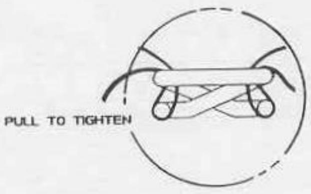
NOTE:
CMOS COMPONENTS ARE STATIC SENSITIVE. HANDLE WITH CAUTION

A2 MAIN CONTROL - A700 SPARE PARTS

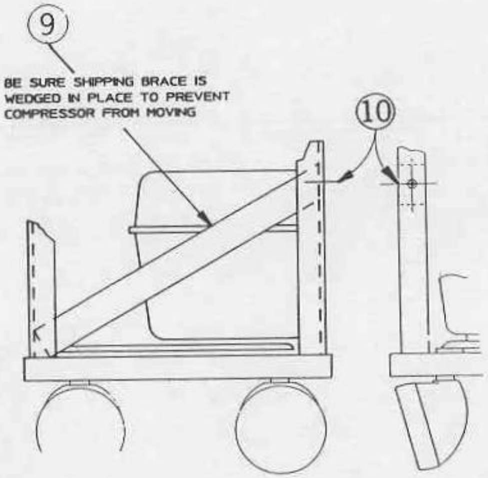
GAYMAR P/N	DESIGNATOR	DESCRIPTION
90700-000	C1, C5, C19, C20 C21, C26, C27, C60	CAPACITOR 10uf/50V
90995-000	C63, C64	CAPACITOR 100uf/25V
90701-001	C2, C4, C6, C8, C9 C10, C17, C18, C45-C58	CAPACITOR .05uf/25V
90702-000	C3, C7, C11, C14, C16, C65, C66	CAPACITOR 100pf/500V
90703-000	C12, C15, C22, C23	CAPACITOR 2.2uf/63V
90701-004	C13, C24, C28, C30, C31	CAPACITOR 0.1uf/25V
90504-000	C29	CAPACITOR 33ufTANTALUM
90704-000	C36	CAPACITOR 47uf/35V
90741-002	C59	CAPACITOR .01uf/630V
90707-000	C44	CAPACITOR 33uf/35V
90701-006	C61	CAPACITOR .01uf/25V
90708-003	R1, R2, R5, R8, R10, R16, R18, R20, R21, R24, R79, R80, R93, R95	RESISTOR 1K, 1%, 1/4W
90092-067	R3	RESISTOR 5.6K, 5%, 1/4W
90092-049	R4, R22, R23, R48, R50, R87, R88, R96, R97, R123	RESISTOR 1K, 5%, 1/4W
90708-008	R7	RESISTOR 4.75K, 1%, 1/4W
90335-012	R11	RESISTOR 12.4K, .1%, 1/8W
90335-011	R12	RESISTOR 5.7K, .1%, 1/8W
90708-005	R13	RESISTOR 1.78K, 1%, 1/4W
90708-004	R19	RESISTOR 1.5K, 1%, 1/4W
90708-013	R31, R132	RESISTOR 49.9K, 1%, 1/4W
90708-011	R29, R128, R129	RESISTOR 20K, 1%, 1/4W
90708-009	R27, R73	RESISTOR 4.99K, 1%, 1/4W
90708-010	R28, R74, R75, R131	RESISTOR 10K, 1%, 1/4W
90708-014	R32, R77, R78	RESISTOR 100K, 1%, 1/4W
90708-015	R33, R133	RESISTOR 200K, 1%, 1/4W
90708-030	R15, R94	RESISTOR 1.3K, 1%, 1/4W
90708-016	R34	RESISTOR 402K, 1%, 1/4W
90708-029	R130	RESISTOR 2M, 1%, 1/4W
90092-033	R36	RESISTOR 220 OHM, 5%, 1/4W
90708-002	R37	RESISTOR 442 OHM, 1%, 1/4W
90092-097	R39, R40, R41, R43, R44, R45, R102, R108, R109,R124,R137,R139	RESISTOR 100K, 5%, 1/4W
90092-327	R121	RESISTOR 4.99M, 1%, 1/8W
90092-073	R42, R53, , R54, R60, R61, R66-R69, R105, R111, R112, R122, R125	RESISTOR 10K, 5%, 1/4W
90092-056	R126	RESISTOR 2K, 5%, 1/4W
90092-089	R49, R52, R64, R65, R91, R92, R100, R101, R114	RESISTOR 47K, 5%, 1/4W
90092-024	R56, R86	RESISTOR 243 OHM, 1%, 1/4W
90092-047	R58, R59	RESISTOR 820 OHM, 5%, 1/4W
90092-065	R62, R63, R71, R76, R107, R113	RESISTOR 4.7K, 5%, 1/4W
90708-028	R81	RESISTOR 402 OHM, 1%, 1/4W
90092-113	R98, R99	RESISTOR 470K, 5%, 1/4W
90092-143	R110	RESISTOR 8.2M, 5%, 1/4W
90092-123	R70	RESISTOR 1.2M, 5%, 1/4W
90092-121	R82, R104	RESISTOR 1M, 5%, 1/4W
90092-145	R47, R51, R89, R90	RESISTOR 10M, 5%, 1/4W
90708-031	R136	RESISTOR 37.4 OHM, 1%, 1/4W
90095-047	R127	RESISTOR 820K, 5%, 1/2W
90708-027	R25	RESISTOR 2K, 1%, 1/4W
90708-007	R26	RESISTOR 4.02K, 1%, 1/4W
90092-084	R115	RESISTOR 30K, 5%, 1/4W
90708-012	R30	RESISTOR 40.2K, 1%, 1/4W
90708-019	R46, R83	RESISTOR 4.12K, 1%, 1/4W
90092-383	R84	RESISTOR 169 OHM, 1%, 1/4W
90092-384	R57	RESISTOR 210 OHM, 1%, 1/4W
90092-108	R103	RESISTOR 300K, 5%, 1/4W
90714-000	Q1, Q7-Q12, Q14	TRANSISTOR 2N3904
90736-000	Q2, Q5, Q6, Q15	TRANSISTOR 2N5087
90738-000	Q3, Q4, Q16	TRANSISTOR 2N5654
90737-001	Q13	TRANSISTOR 2N6715
90728-003	R6	TRIM POT 500 OHM, 15 TURN CERMET
90728-002	R9, R17, R35	TRIM POT 100 OHM, 15 TURN CERMET
90728-004	R14, R55, R85	TRIM POT 1K, 15 TURN CERMET
90728-001	R38	TRIM POT 50 OHM, 15 TURN CERMET
90728-005	R72, R117	TRIM POT 10K, 15 TURN CERMET
90728-008	R120	TRIM POT 5K, 15 TURN CERMET
90456-000	CR2, CR4-CR8, CR10-CR24, CR26-CR32, CR34	DIODE 1N914
90730-000	CR1	DIODE LM336Z
90727-000	CR33	DIODE 1N4004
90715-001	CR35	DIODE 1N749
90733-002	U1, U2, U5, U12	INTEGRATED CIRCUIT LM741
90733-003	U3, U4, U10, U11, U20, U21	INTEGRATED CIRCUIT LM308
90734-001	U6, U8, U13, U14	INTEGRATED CIRCUIT LM747
90488-000	U7, U15, U16	INTEGRATED CIRCUIT CD4001
90733-001	U9, U17, U19	INTEGRATED CIRCUIT LM555
90734-002	U18	INTEGRATED CIRCUIT LM556


8
BOTTOM CAP
6
SUPPORT CARTON
GAYMAR

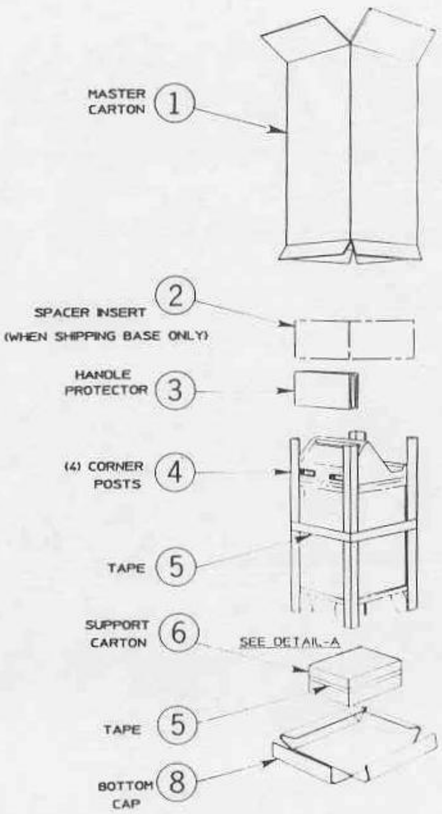
DETAIL A


PULL TO TIGHTEN

DETAIL C


9
BE SURE SHIPPING BRACE IS WEDGED IN PLACE TO PREVENT COMPRESSOR FROM MOVING
10

DETAIL B


MASTER CARTON 1
SPACER INSERT (WHEN SHIPPING BASE ONLY) 2
HANDLE PROTECTOR 3
(4) CORNER POSTS 4
TAPE 5
SUPPORT CARTON 6
SEE DETAIL-A
TAPE 5
BOTTOM CAP 8

EXPLODED VIEW

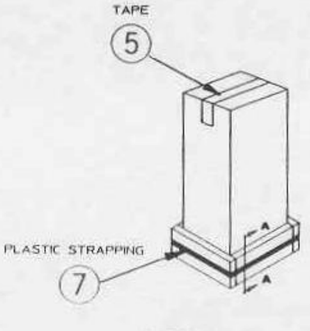
FIG. 6.25

INSTRUCTIONS

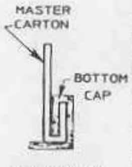
1. DRAIN ALL WATER FROM UNIT (SEE OPERATORS INSTRUCTIONS).
2. REMOVE LOWER WRAPAROUND. INSERT SHIPPING BRACE (ITEM 9) AS SHOWN IN DETAIL B. INSERT SCREW THROUGH HOUSING FRAME AND INTO SHIPPING BRACE AS SHOWN. (NOTE: SCREW NOT REQUIRED IF HOLE IN HOUSING FRAME IS NOT PROVIDED).
3. PLACE BOTTOM CAP (ITEM 8) ON FLOOR, AS SHOWN IN EXPLODED VIEW.
4. TAPE UP SUPPORT CARTON (ITEM 6) AND PLACE ON TOP OF BOTTOM CAP.
5. PLACE THE UNIT ON TOP OF SUPPORT CARTON WITH THE WHEELS ORIENTED AS SHOWN IN DETAIL A.
6. TAPE DOWN THE ALARM SILENCER SWITCH (AUTOMATIC MODELS ONLY) AND CELSIUS TO FAHRENHEIT SWITCH (NEWER MODELS ONLY).
7. POSITION THE FOUR CORNER POSTS (ITEM 4) ON THE CORNERS OF THE UNIT. NOTE: HOLE IN LEFT REAR CORNER POST TO BE POSITIONED DIRECTLY OVER POWER CORD BUSHING IN HOUSING. TAPE CORNER POSTS IN PLACE USING ITEM 5. (NO SPECIAL POSITIONING IS REQUIRED ON THE OTHER THREE CORNER POSTS).
8. WHEN RETURNING THE CHASSIS ASSEMBLY ONLY (MT-4000), PLACE THE SPACER INSERT (ITEM 2) ON TOP OF THE CHASSIS.
9. SLIDE THE MASTER CARTON (ITEM 1) OVER THE UNIT.
10. PUSH THE HANDLE PROTECTOR (ITEM 3) DOWN BEHIND THE TWO FRONT CORNER POSTS SO THAT IT RESTS ON TOP OF THE HANDLE.
11. TAPE THE TOP OF THE BOX CLOSED, USING ITEM 5 (SUPPLIED).
12. BAND THE BOTTOM CAP WITH 8 FT. PLASTIC STRAP (ITEM 7). SECURE IN PLACE WITH ATTACHMENT CLIP (SEE DETAIL C). NOTE: BANDING WILL BE EASIER BY PLACING UNIT ON ITS SIDE. (IF STEEL BANDING IS AVAILABLE, USE IN LIEU OF PLASTIC BANDING FOR ADDED PROTECTION).

CLASSIFY MEDITHERM RETURNS AS FOLLOWS:

DESCRIPTION:	POWER PUMP NO. 128000
CLASS:	85
SHIPPING WEIGHT:	150 LBS.


TAPE
5
A
A
PLASTIC STRAPPING
7

ASSEMBLED CARTON


MASTER CARTON
BOTTOM CAP

SECTION A-A

QUAN	PART NO.		DESCRIPTION	ITEM
1	90259-011	S	SCREW	10
1	60149-000	S	SHIPPING BRACE	9
1	60115-000	C	BOTTOM CAP	8
1	60139-000	S	PLASTIC STRAP W/ CLIP (8 FT)	7
1	60117-000	B	SUPPORT CARTON	6
A/R	50515-000	S	TAPE, 3/4" NYLON FILAMENT	5
4	60116-000	B	CORNER POST	4
1	60118-000	B	HANDLE PROTECTOR	3
1	60136-000	B	INSERT (SPACER)	2
1	60114-000	C	MASTER CARTON	1
☒	77215-000		CUSTOMER RETURN KIT	

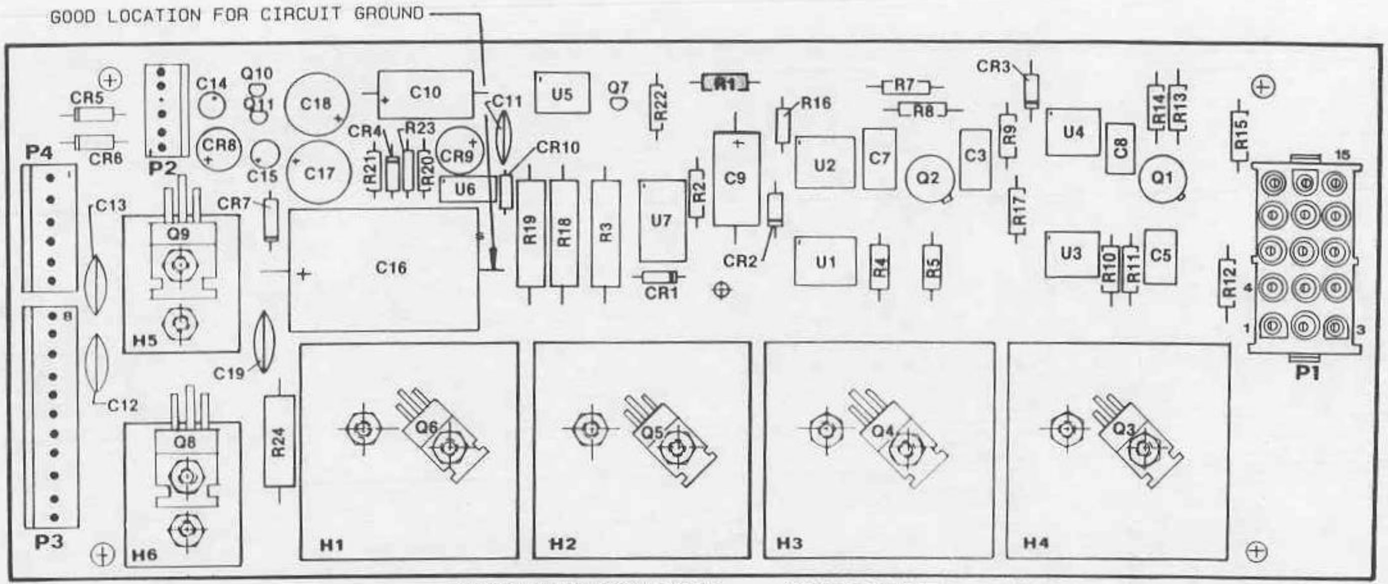

GOOD LOCATION FOR CIRCUIT GROUND
CR5
CR6
P4
P2
C14
Q10
Q11
CR8
C15
C18
C17
C10
CR4
R23
R21
R20
CR9
U6
C11
CR10
U5
Q7
R22
R1
R16
R7
R8
CR3
R9
U4
C8
R14
R13
R15
Q1
C13
CR7
Q9
H5
C16
R19
R18
R3
U7
R2
C9
CR2
CR1
U2
C7
Q2
C3
U1
R4
R5
R17
U3
R10
R11
C5
R12
15
4
1
3
P1
C19
C12
P3
Q8
H6
R24
Q6
Q5
Q4
Q3
H1
H2
H3
H4

FIG. 6.24

A3 POWER SUPPLY BOARD SPARE PARTS

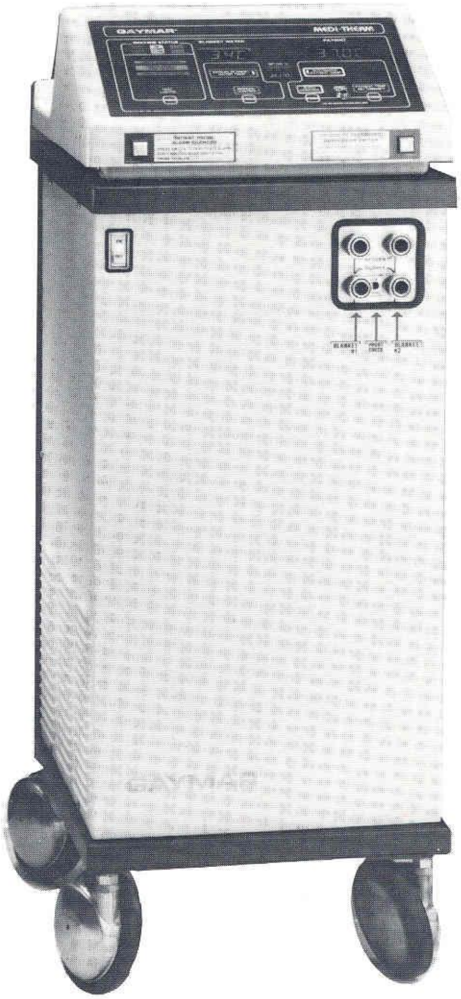
GAYMAR P/N	DESIGNATOR	DESCRIPTION
90709-000	Q3, Q4, Q5, Q6	TRIAC MOTOROLA 2N6346A
90482-000	Q1, Q2	TRIAC RCA T2300
90714-000	Q7	TRANSISTOR 2N3904
90718-000	U1, U2, U4, U6	INTEGRATED CIRCUIT MOTOROLA MOC-3010
90886-000	U3	INTEGRATED CIRCUIT MOTOROLA MOC-3021
90574-000	U5	INTEGRATED CIRCUIT GE H11A1
90454-000	U7	INTEGRATED CIRCUIT GAYMAR
90710-000	Q8	INTEGRATED CIRCUIT NATIONAL LM340T-5
90711-000	Q9	INTEGRATED CIRCUIT NATIONAL LM340T-12
90712-001	Q10	INTEGRATED CIRCUIT NATIONAL LM320L-12
90712-000	Q11	INTEGRATED CIRCUIT NATIONAL LM320L-5
90491-000	CR8, CR9	BRIDGE RECTIFIER GENERAL INST. W04M
90717-000	CR5, CR6	DIODE IN5391
90727-000	CR7	DIODE IN4004
90456-000	CR1, CR2, CR3	DIODE IN914
90715-001	CR4	DIODE IN749
90716-000	CR10	DIODE GE P/N ST2

GAYMAR P/N	DESIGNATOR	DESCRIPTION
90898-002	C5	CAPACITOR .001uf/600V
90719-000	C16	CAPACITOR 2200uf/35V
90720-000	C17, C18	CAPACITOR 470uf/35V
90701-004	C12, C13, C19	CAPACITOR 0.1uf/25V
90703-000	C14, , C15	CAPACITOR 2.2uf/63V
90898-001	C7, C8	CAPACITOR .01uf/400V
90721-000	C9, C10	CAPACITOR 100uf/50V
90701-008	C11	CAPACITOR 0.01uf/100V
90465-030	R24	RESISTOR 15 OHM, 5%, 5W
90096-016	R4, R7, R10, R13	RESISTOR 180 OHM, 10%, 1/2W
90096-017	R5, R8, R11, R14	RESISTOR 220 OHM, 10%, 1/2W
90096-013	R12	RESISTOR 100 OHM, 10%, 1/2W
90092-047	R16	RESISTOR 820 OHM, 5%, 1/4W
90465-116	R3	RESISTOR 8.2K, 5%, 5W
90465-107	R18	RESISTOR 5K, 5%, 5W
90095-039	R17, R20	RESISTOR 390 OHM, 5%, 1/2W
90095-052	R21	RESISTOR 1.3K, 5%, 1/2W
90465-102	R19	RESISTOR 3.9K, 5%, 5W
90092-138	R22	RESISTOR 5.1 OHM, 5%, 1/4W
90095-067	R23	RESISTOR 5.6K, 5%, 1/2W
90708-023	R2	RESISTOR 806 OHM, 1%, 1/4W
90095-065	R9, R15	RESISTOR 4.7 OHM, 5%, 1/2W
90464-002	R1	TRIM POTENTIOMETER, 500 OHM

GAYMAR®

MEDI-THERM Hyper/Hypothermia

OPERATING INSTRUCTION MANUAL
AUTOMATIC/MANUAL CONTROL
MODEL MTA-4700



UL LISTED 303L

SP STANDARD (NORME) C22.2 NO. 125 RISK CLASS (CATEGORIE DE RISQUES) NO. 2G

P/N 06685-000

REUSABLE CONTAINER RC-1
USAGE INSTRUCTIONS

1. With unit in upright position rotate latches to unfasten container sections.
2. Using handles provided lift upper container section off base section.
3. Remove accessories.
4. Lift unit out of base section.
5. If transformer is included, remove transformer from base section and follow transformer usage instructions.
6. Follow start-up instructions in Operating Instruction Manual.
7. To repack, reverse unpacking instructions. See inside diagram for positioning of components.
8. To clean reusable container, wipe with cloth wetted with water/soap solution.

TRANSFORMER MODEL XFM-1
USAGE INSTRUCTIONS

Note: This unit is for use with Gaymar Medi-Therm Model MTA-4700 only.

1. Place XMF-1 unit onto shoulder bolts provided on rear of MTA-4700 unit.
2. Make certain that the circuit breaker, on-off switch of MTA-4700 and XFM-1 units are in the off position.
3. Plug power cord of XMF-1 into 220V, 50/60 HZ outlet.
4. Plug power cord of MTA-4700 unit into receptacle on side of XFM-1.
5. Turn circuit breaker of XMF-1 to on position.
6. Follow start-up instructions for MTA-4700 unit.

P/N 07075-000

INTRODUCTION

The Gaymar Automatic and Manual Patient Control System consists of the Model MTA-4700 MEDI-THERM machine, and the efficient button design blankets.

Gaymar's temperature control system incorporates the latest in state-of-the-art technology, conserves space, and provides features that insure reliable, simplified operation.

As with any patient therapy equipment, an understanding of the System and its operation is essential in order to fully and safely utilize its capability.

For this reason we ask that you carefully read the following operating instructions, and the precautions to insure patient safety.

Complete factory support is available from Gaymar Industries, Inc., and your Gaymar Representative. It is recommended that you have in-service training for the MEDI-THERM system by your Gaymar Representative.

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START-UP PROCEDURES 11

OPERATING INSTRUCTIONS 12

PATIENT SAFETY
(and other precautions) 13

CARE OF MEDI-THERM 14

ALERTS/TROUBLESHOOTING 15

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SYSTEM FAMILIARIZATION

Maximum benefit to your patient, at the greatest margin of safety, requires a thorough knowledge and understanding of the correct operation and application of this unit. It is important, therefore, that you read and understand the Operating Instructions and all Precautions (refer to page 9) prior to use.

The Gaymar MEDI-THERM System is designed to regulate patient temperature by the application of hyper/hypothermia blankets, through which temperature controlled water is circulated.

Gaymar's Model MTA-4700 machine may be operated to provide patient therapy in two basic modes, Automatic and Manual. In Automatic Mode, patient temperature is automatically regulated to an operator-specified set point. In Manual Mode, the operator must observe patient temperature, and adjust the blanket water temperature to obtain the desired results.

MEDI-THERM also features a convenient means of monitoring patient temperature, without providing therapy, yet with the machine in standby condition, available for immediate use. This third operating mode, Patient Temperature Monitoring, is achieved by utilizing the accurate sensing capability of the Patient Probe.

The main components of the Gaymar System are shown in Figure (1), and include the Model MTA-4700 MEDI-THERM machine, one eight (8) foot Connector Hose, the Patient Probe, and the Gaymar "button design" Thermia Blanket.

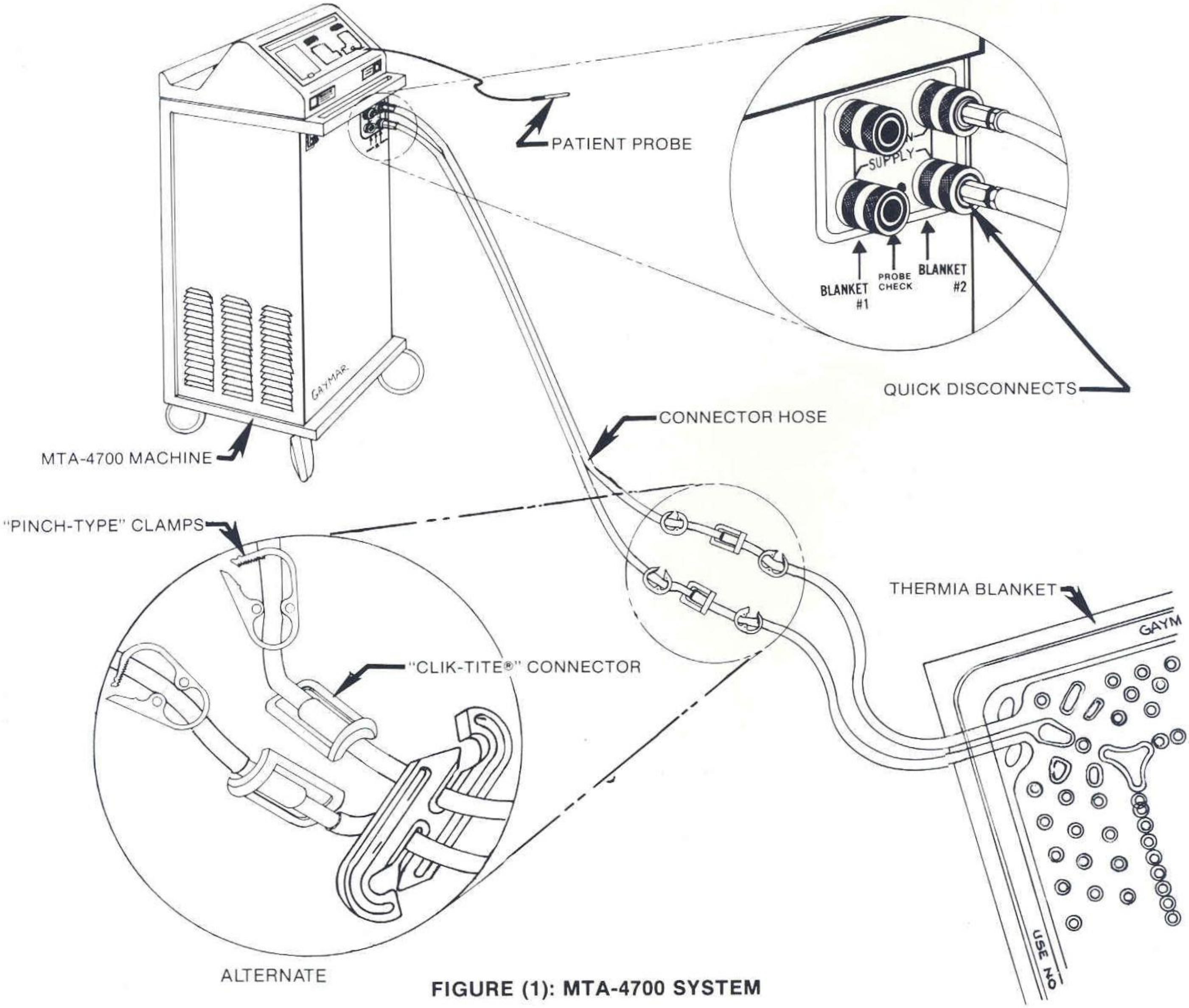
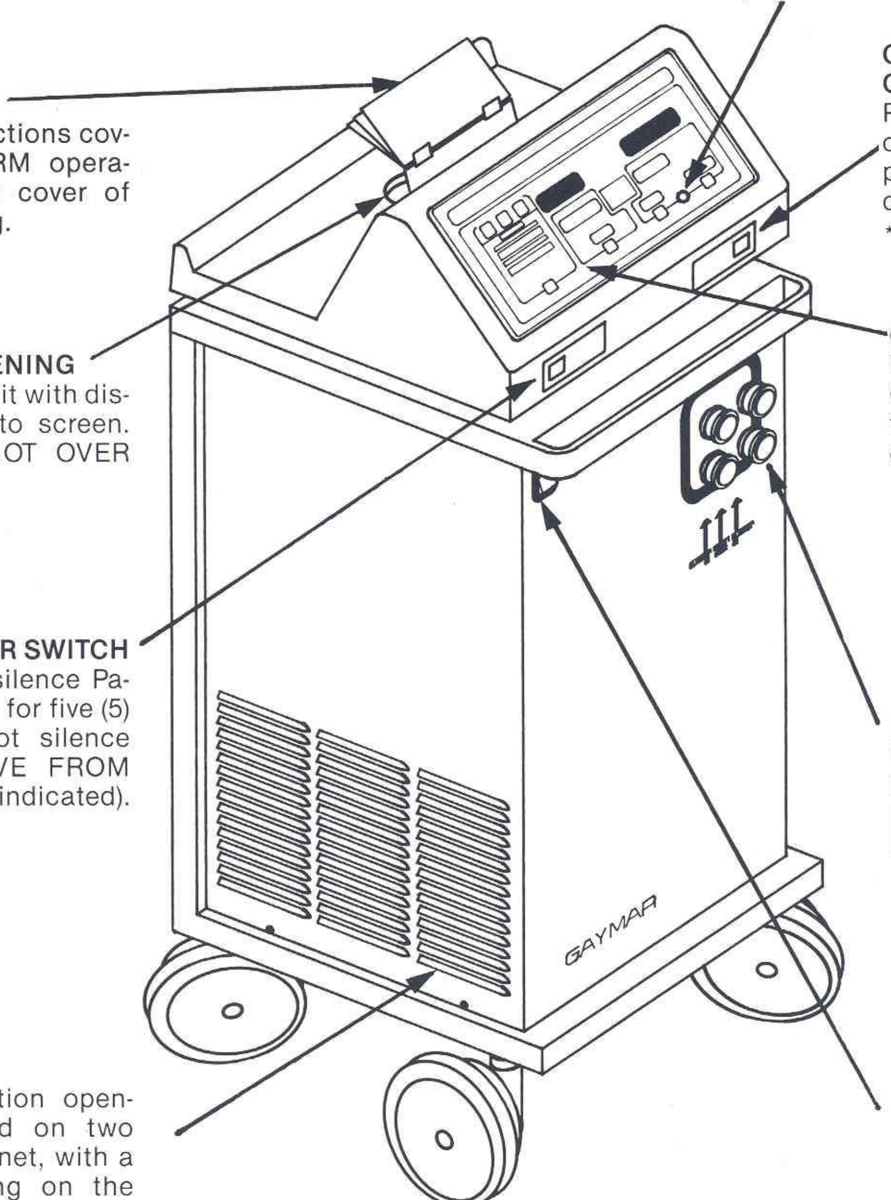

PATIENT PROBE
SUPPLY
BLANKET #1
PROBE CHECK
BLANKET #2
QUICK DISCONNECTS
CONNECTOR HOSE
GAYMAR
MTA-4700 MACHINE
"PINCH-TYPE" CLAMPS
THERMIA BLANKET
GAYM
"CLIK-TITE®" CONNECTOR
USE NO
ALTERNATE

FIGURE (1): MTA-4700 SYSTEM

MTA-4700 FEATURES & CONTROLS

The main features of the MEDI-THERM unit are shown in Figure (2). Take a few minutes to become familiar with their location and purpose before reading the Start-Up Procedures or attempting to place the unit in operation.



PATIENT PROBE JACK
Accepts Patient Probe Plug which connects patient probe to machine. Use YSI 400 Series Probe or equivalent.

OPERATING INSTRUCTIONS
Numbered instructions covering MEDI-THERM operation attached to cover of water fill opening.

CELSIUS TO FAHRENHEIT CONVERSION SWITCH*
Press and hold switch to observe blanket water and patient temperatures in degrees Fahrenheit.

*120 Volt units only.

WATER FILL OPENING
Lift cover to fill unit with distilled water. Fill to screen. CAUTION: DO NOT OVER FILL.

OPERATOR CONTROL PANEL
Contains indicators and controls used in MEDI-THERM operation.

PATIENT PROBE ALARM SILENCER SWITCH
Can be used to silence Patient Probe Alarm for five (5) minutes. (Will not silence alarm if REMOVE FROM SERVICE alert is indicated).

BLANKET MANIFOLD & PROBE CHECK WELL
Blanket(s) water supply connections. Manifold Quick Disconnect fittings are labeled SUPPLY and RETURN.

AIR VENTS
Louvered ventilation openings are located on two sides of the cabinet, with a screened opening on the rear. Keep clear to assure adequate air circulation.

ON-OFF SWITCH (Circuit Breaker)
Controls power to MEDI-THERM.

FIGURE (2): MTA-4700 MAIN FEATURES

OPERATOR CONTROL PANEL

In order to provide for simplified operation, the MTA-4700 Control Panel is divided into sections according to function and use. Main panel sections are shown and described in Figure (3).

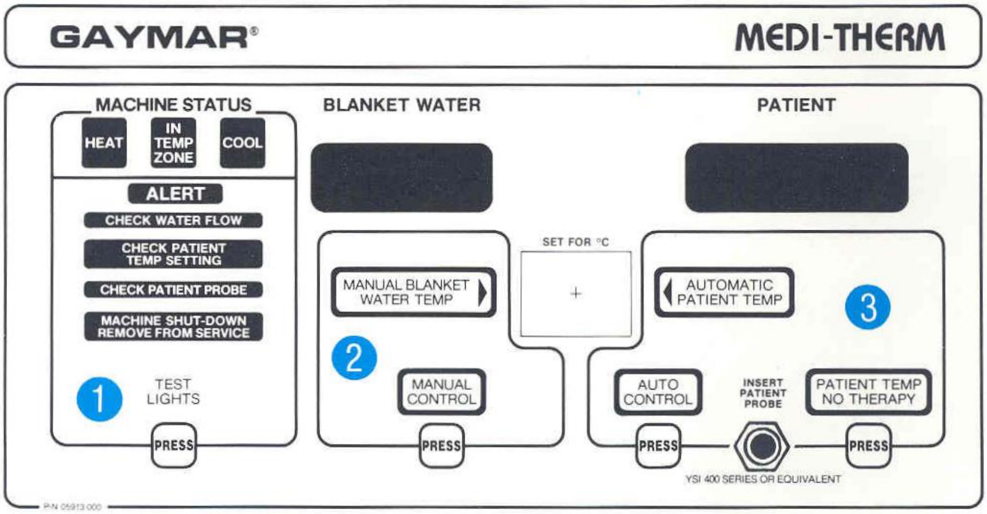

GAYMAR®
MEDI-THERM
MACHINE STATUS
HEAT
IN TEMP ZONE
COOL
ALERT
CHECK WATER FLOW
CHECK PATIENT TEMP SETTING
CHECK PATIENT PROBE
MACHINE SHUT-DOWN REMOVE FROM SERVICE
1
TEST LIGHTS
PRESS
BLANKET WATER
MANUAL BLANKET WATER TEMP
2
MANUAL CONTROL
PRESS
SET FOR °C
PATIENT
AUTOMATIC PATIENT TEMP
3
AUTO CONTROL
PRESS
INSERT PATIENT PROBE
PATIENT TEMP NO THERAPY
PRESS
YSI 400 SERIES OR EQUIVALENT

FIGURE (3): CONTROL PANEL LAYOUT

① STATUS/ALERT SECTION (Figure 5)

Contains machine STATUS and ALERT displays and indicator TEST BUTTON. STATUS indicators describe normal operation and patient therapy being provided. ALERT indicators become illuminated when operator attention is required. TEST LIGHTS button allows operator to confirm that all indicators are working.

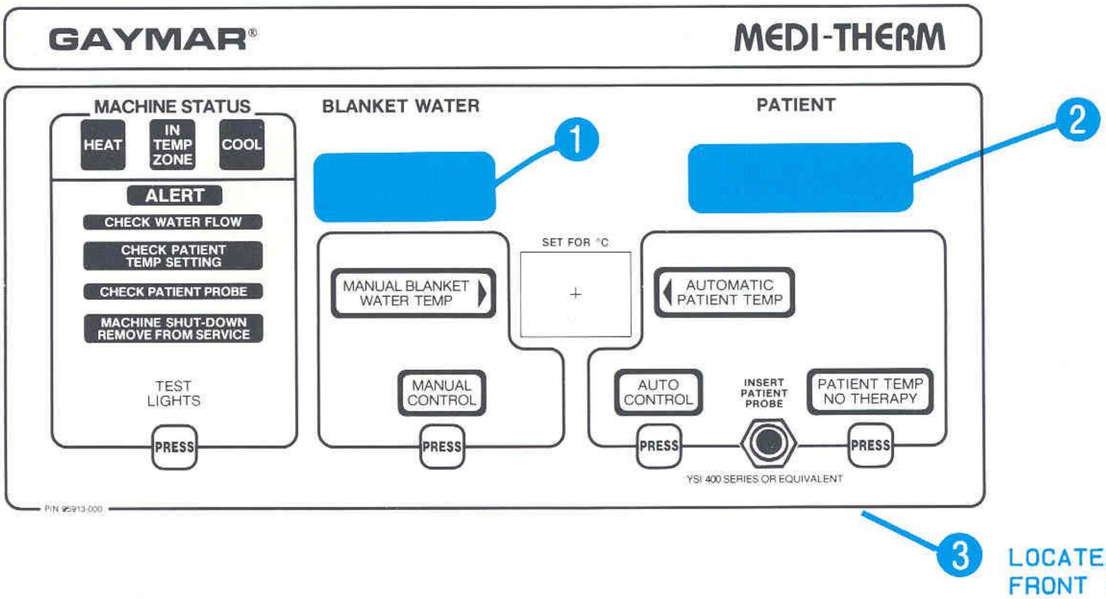
② BLANKET WATER SECTION (Figure 6)

This Control Panel Section should be used when operation in MANUAL CONTROL mode is desired. To enter this mode, simply press the MANUAL CONTROL button. The digital blanket water display indicates actual temperature of the water going to the blanket. The Temperature Control Switch is used to set the desired blanket water temperature.

③ PATIENT SECTION (Figure 7)

Controls and indicators in this section should be used when MEDI-THERM is placed in AUTOMATIC CONTROL mode, or if you want to monitor patient temperature without providing therapy. When operating in the AUTOMATIC CONTROL mode, the Temperature Control Switch is used to set the desired patient temperature, and the patient display will indicate actual patient temperature.

TEMPERATURE DISPLAYS


GAYMAR®
MEDI-THERM
MACHINE STATUS
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BLANKET WATER
PATIENT
SET FOR °C
MANUAL BLANKET WATER TEMP
AUTOMATIC PATIENT TEMP
MANUAL CONTROL
AUTO CONTROL
INSERT PATIENT PROBE
PATIENT TEMP NO THERAPY
YSI 400 SERIES OR EQUIVALENT
①
②
③

LOCATED ON FRONT OF COVER

FIGURE (4): TEMPERATURE DISPLAY

① BLANKET WATER Temperature Indicator—displays temperature of the water being delivered to the blanket. This display will be on when operating in either MANUAL CONTROL or AUTOMATIC CONTROL modes.

② PATIENT Temperature Indicator—displays the actual patient temperature. This display will be on when AUTOMATIC CONTROL and PATIENT TEMP NO THERAPY modes are selected or when MANUAL CONTROL is selected and a patient probe is plugged into the Patient Probe jack.

③ CELSIUS TO FAHRENHEIT CONVERSION—Blanket Water and Patient indicators normally display temperatures in °C; temperatures can momentarily be displayed in °F by pressing and holding the CELSIUS TO FAHRENHEIT CONVERSION SWITCH.* Upon releasing the switch, the temperature displays will revert to °C.

*120 volt units only

STATUS/ALERT INDICATORS

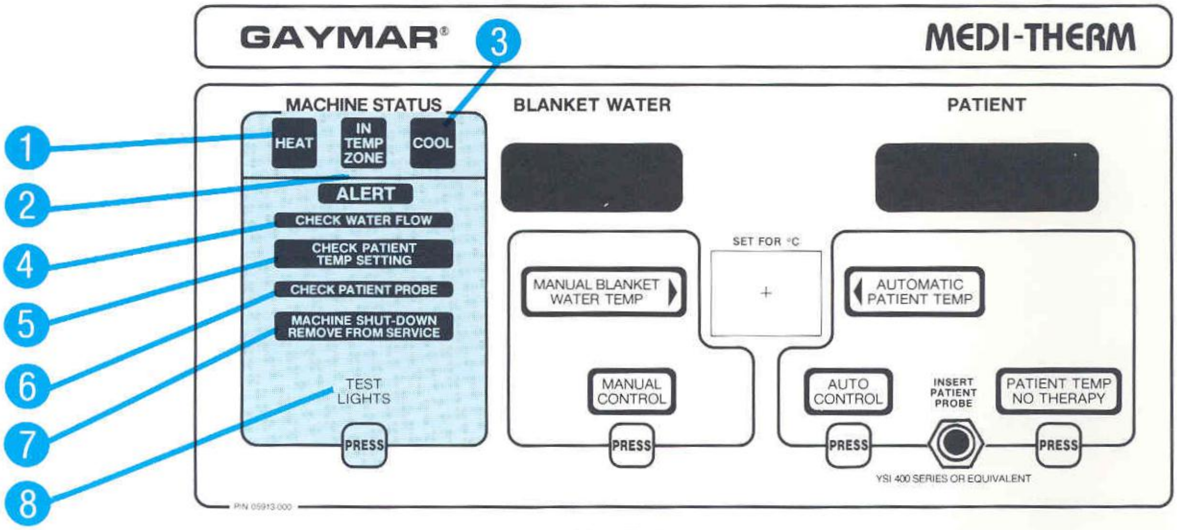

GAYMAR®
MEDI-THERM
③
MACHINE STATUS
HEAT
IN TEMP ZONE
COOL
ALERT
CHECK WATER FLOW
CHECK PATIENT TEMP SETTING
CHECK PATIENT PROBE
MACHINE SHUT-DOWN REMOVE FROM SERVICE
TEST LIGHTS
PRESS
BLANKET WATER
PATIENT
SET FOR °C
MANUAL BLANKET WATER TEMP
AUTOMATIC PATIENT TEMP
MANUAL CONTROL
AUTO CONTROL
INSERT PATIENT PROBE
PATIENT TEMP NO THERAPY
PRESS
PRESS
PRESS
YSI 400 SERIES OR EQUIVALENT
P/N 05913-000
①
②
④
⑤
⑥
⑦
⑧

FIGURE (5): STATUS/ALERT INDICATORS

STATUS DISPLAYS

STATUS displays function in both AUTOMATIC CONTROL and MANUAL CONTROL modes, and indicate the condition of Blanket Water temperature or Patient temperature relative to the desired temperature setting:

① HEAT - When ON, indicates Blanket Water is being HEATED. Maximum blanket temperature is 42°C.

② IN TEMP ZONE - When ON, shows MEDI-THERM is controlling at the desired temperature setting.

③ COOL - When ON, indicates Blanket Water is being COOLED. Minimum blanket temperature is 4°C.

ALERT INDICATORS

ALERT indicators become illuminated when some form of operator action is required.

④ CHECK WATER FLOW - When ON, indicates the flow of water to the blanket has been restricted. (Refer to Alerts/Troubleshooting, Page 15).

⑤ CHECK PATIENT TEMP SETTING - This Indicator functions only in AUTOMATIC CONTROL mode. When ON, indicates that the requested temperature is not within the normal range (25°C to 41°C) for patient temperature control. Recheck the AUTOMATIC PATIENT TEMP control setting.

⑥ CHECK PATIENT PROBE - When ON, indicates patient probe is sensing an abnormal patient temperature range (below 25°C or above 45°C). It may indicate patient probe has become dislodged, incorrect probe is being used, or probe has become defective. (See Alerts/Troubleshooting, Page 15). This alert is accompanied by an audible alarm which may be silenced for 5 minutes by pressing PATIENT PROBE ALARM SILENCER switch.

⑦ MACHINE SHUT-DOWN REMOVE FROM SERVICE - When ON, indicates unit has shutdown due to blanket water temperature exceeding either the high or the low limit thermostats. REMOVE FROM SERVICE immediately.

⑧ TEST LIGHTS - Used to confirm that all indicator lights and digital displays are working, and that audible alarm is functioning.

BLANKET WATER CONTROLS

MANUAL PATIENT TEMPERATURE CONTROL MODE

Controls and indicators contained in the Blanket Water Controls of the Operator Control Panel are shown in Figure (6). They should be used when MEDI-THERM is being operated in the MANUAL CONTROL mode.

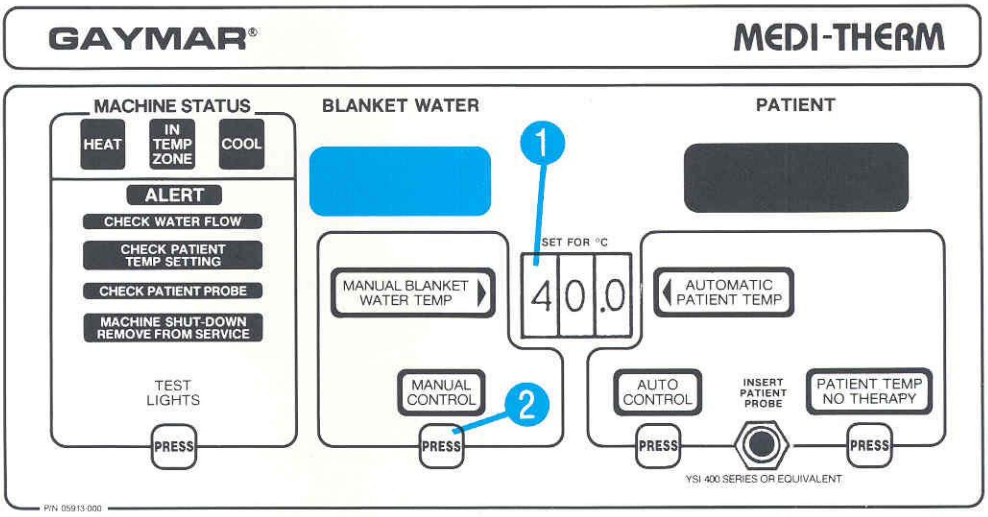

GAYMAR®
MEDI-THERM
MACHINE STATUS
HEAT
IN TEMP ZONE
COOL
ALERT
CHECK WATER FLOW
CHECK PATIENT TEMP SETTING
CHECK PATIENT PROBE
MACHINE SHUT-DOWN REMOVE FROM SERVICE
TEST LIGHTS
PRESS
BLANKET WATER
1
SET FOR °C
MANUAL BLANKET WATER TEMP
40.0
MANUAL CONTROL
2
PRESS
PATIENT
AUTOMATIC PATIENT TEMP
AUTO CONTROL
PRESS
INSERT PATIENT PROBE
PATIENT TEMP NO THERAPY
PRESS
YSI 400 SERIES OR EQUIVALENT
P/N 05913-000

FIGURE (6): BLANKET WATER CONTROLS

When operating in the MANUAL CONTROL mode, MEDI-THERM controls the temperature of the Blanket Water as set by the operator on the Temperature Control Switch. The operator must observe the patient's temperature, and manually adjust the Blanket Temperature to obtain the desired results.

① MANUAL BLANKET WATER TEMP - Temperature Control Switch for setting the desired Blanket Water temperature in °C.

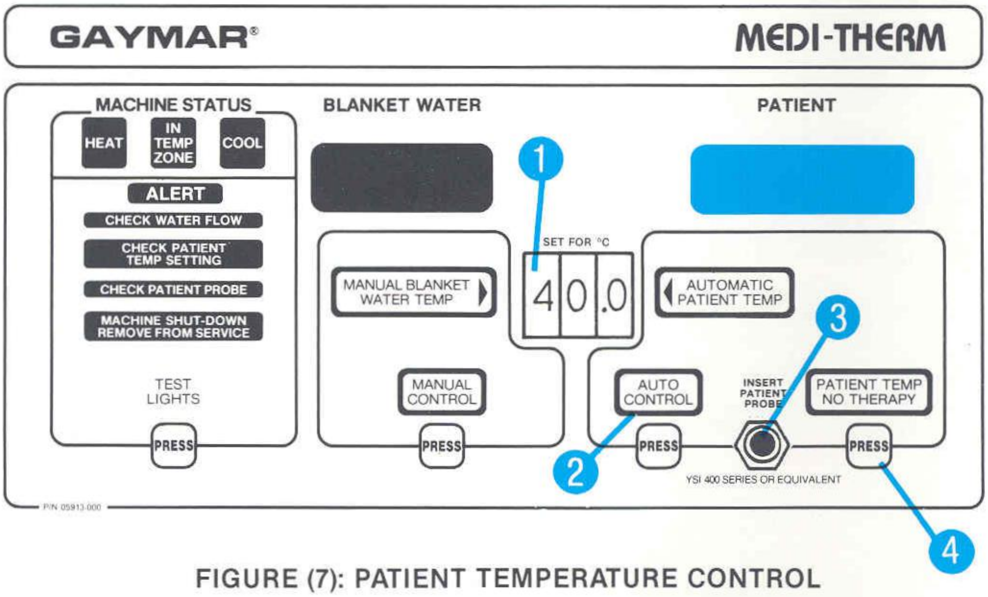
② MANUAL CONTROL - Press to enter manual patient temperature control mode of operation.

PATIENT TEMPERATURE CONTROLS

AUTOMATIC PATIENT TEMPERATURE CONTROL MODE

Controls and indicators for using MEDI-THERM in the AUTOMATIC CONTROL mode are shown in Figure (7).

When operating in the AUTOMATIC CONTROL mode, the patient's temperature is being regulated by MEDI-THERM. The machine constantly compares actual patient temperature with the set point value, and automatically adjusts the Blanket Water temperature so that the desired patient temperature is achieved.


GAYMAR®
MEDI-THERM
MACHINE STATUS
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CHECK PATIENT PROBE
MACHINE SHUT-DOWN REMOVE FROM SERVICE
TEST LIGHTS
PRESS
BLANKET WATER
MANUAL BLANKET WATER TEMP
MANUAL CONTROL
PRESS
SET FOR °C
4 0 .0
PATIENT
AUTOMATIC PATIENT TEMP
AUTO CONTROL
PRESS
INSERT PATIENT PROBE
PATIENT TEMP NO THERAPY
PRESS
YSI 400 SERIES OR EQUIVALENT
P/N 05913-000
1
2
3
4

FIGURE (7): PATIENT TEMPERATURE CONTROL

① AUTOMATIC PATIENT TEMP - Temperature Control Switch for setting the desired Patient Temperature in °C.

② AUTOMATIC CONTROL - Press to enter automatic patient temperature control mode.

③ PATIENT PROBE JACK - Jack accepts plug end of Patient Probe. Patient Temperature can also be displayed in the MANUAL CONTROL mode simply by plugging in a probe.

NOTES: 1) Make sure probe plug is fully seated. ***Use YSI 400 Series Probes or equivalent.***

2) If in doubt, verify that the correct probe is being used and is operating properly by performing a probe check test. See page 5 for instructions.

④ PATIENT TEMP NO THERAPY - Press when no patient temperature therapy is required, but monitoring of patient temperature is desired. (MEDI-THERM is placed on standby, and no therapy is provided).

START-UP PROCEDURES

Complete the following Start-Up procedures each time the MEDI-THERM System is placed in operation. For convenient reference, numbered Instruction Cards have been permanently mounted on the machine. They contain condensed versions of the detailed instructions found in this manual.

(Refer to Number 1 Instruction Card)

1) **DISCONNECT POWER**
Check to make sure that the power cord plug is not connected, and that the On-Off Switch is in the OFF position.

2) **ATTACH BLANKET(S)**
Attach the Thermia Blanket(s) to the MTA-4700 as shown in Figure (1), using the following procedure.

All Gaymar Thermia Blankets require the use of a Connector Hose. This consists of an 8 foot length of twin hose with quick-disconnect (metal) fittings on one end, and Clik-Tite® (white plastic) connectors on the other end.

Connect the Quick Disconnect (metal) fittings to the machine at the Blanket Manifold. One fitting should be attached to a SUPPLY Connector and the other to a RETURN Connector.

To insure a tight connection, push the retaining collar toward the cabinet and insert the metal hose fitting firmly. While holding the fitting, allow the retaining collar to snap back into position. Then check to make sure the fitting is fully engaged by tugging firmly on the hose fitting.

Attach the hose to the blanket by connecting the Clik-Tite connectors, male to female, for blanket and connector hose tubes. Insert the male fittings into the female fittings with a twisting motion. When fittings are fully seated, snap the locking ring into place to assure a positive lock. Figure (1) illustrates locked Clik-Tites.

3) **OPEN FOUR (4) HOSE CLAMPS**
To avoid spillage when the system is shut down or blankets are changed, pinch or slide hose clamps are provided on both the Connector Hoses and the Blanket Hoses. Check to make sure that these four (4) plastic clamps are open. Failure to open hose clamps will prevent water flow, and will trigger the CHECK WATER FLOW Alarm. NOTE: If CHECK WATER FLOW problem is not corrected within 10-15 minutes, the Medi-Therm will automatically shut down.

4) **INSPECT WATER LEVEL**
Check to make sure water is at the proper level by lifting the cover on the Water Fill opening. Fill to screen. CAUTION: DO NOT OVERFILL.

If additional water is required, add *distilled water only.* No mixing of alcohol and water is required.

5) **CONNECT POWER**
Insert the power cord plug into a properly grounded AC receptacle of the correct voltage. Press the On-Off Switch to the ON position. Switch will glow when power is on. To initiate water flow through the Thermia Blanket press either AUTO CONTROL or MANUAL CONTROL pushbuttons, depending upon desired operation. Allow water to circulate through the blanket(s) for 3-5 minutes. Control Panel will be dark until one of the mode switches is pressed. A mode switch must be pressed to initiate operation each time the ON/ OFF Switch is used, or after a power interruption.

6) **REINSPECT WATER LEVEL**
After the blanket(s) are filled, re-check the water level and add more if required.

If there is no water flow, and the CHECK WATER FLOW indicator is ON, turn off the machine, and refer to the Troubleshooting Instructions on page 16 of this Manual.

7) **PERFORM INDICATOR LIGHT TEST**
Since machine indicators are essential to proper machine operation, you should make an Indicator Light Test each time the unit is placed in operation to make sure they are working properly. Perform this test by pressing the TEST LIGHTS switch located on the Control Panel. Temperature displays should indicate "188° E" and "188.8° E," all machine status legends, 3 mode legends and 2 Temperature Control Switch legends should be lit. The audible alarm should sound.

If any indicator does not illuminate, or the alarm does not sound, *remove the unit from service* and request Biomedical Engineering Department servicing.

This completes the sequence of START-UP Procedures for the MEDI-THERM unit. Please proceed to the next section, which contains Operating Instructions for Manual, Automatic and Patient Temperature Monitoring.

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OPERATING INSTRUCTIONS

The Gaymar Model MTA-4700 MEDI-THERM System is designed to operate in three (3) modes; Manual (blanket) Patient Temperature Control, Automatic Patient Temperature Control, and Patient Temperature Monitoring.

Read and understand the contents of this Instruction Manual and associated precautions before using the MTA-4700. Any application of the Hyper/Hypothermia System should be under the direction of the attending physician.

Some applications may require a second blanket in order to achieve additional or more rapid heating or cooling. For these situations, a second thermia blanket may be connected to the Blanket Manifold. The rate of patient heating or cooling may also be increased by positioning half and full-size blankets so that greater body surface is in contact with the blankets.

NOTE: When additional blankets are connected to the MTA-4700, START-UP Procedures should be repeated to confirm flow through both blankets, and that the water supply is at the required level.

CAUTION: If the patient's temperature is not responding and/or does not reach the prescribed temperature in the prescribed time, or deviates from the prescribed temperature range, the attending physician should be promptly notified.

CAUTION: Power interruption will cause machine to go into a standby (no therapy) mode.

MANUAL CONTROL MODE

(Refer to Number 1 (Backside) Instruction Card)

When operating in the MANUAL CONTROL mode, the MTA-4700 MEDI-THERM supplies blanket water at the temperature set on the Temperature Control Switch. Solid state temperature controls within the unit monitor water temperature, and the unit heats or cools the blanket water as required.

The MANUAL CONTROL mode requires the operator to make frequent checks of patient temperature, and if necessary, to adjust the Blanket Temperature setting to achieve the desired patient temperature.

1) Inspect unit to insure that all Start-Up Procedures have been properly completed, and that the On-Off Switch is ON.

2) Adjust the Temperature Control Switch until it indicates the desired blanket temperature in °C.

3) Press MANUAL CONTROL Switch on Control Panel. Both MANUAL CONTROL and MANUAL BLANKET WATER TEMP indicators will illuminate.

   When the blanket temperature stabilizes at the Set Point level, the IN TEMP ZONE indicator will light, indicating that the desired blanket water temperature is being maintained.

4) Patient temperature and skin condition should be checked every 20 minutes, or as directed by the physician.

   NOTE: Patient temperature can be monitored while operating in the Manual Mode. To use this MEDI-THERM feature, the Patient Probe must be in place, and the MANUAL CONTROL switch should be pressed. Patient temperature will be indicated on the digital PATIENT temperature display.

AUTOMATIC PATIENT CONTROL

(Refer to Number 2 (Backside) Instruction Card)

When operating in the AUTOMATIC CONTROL mode the patient's temperature is being regulated by the MTA-4700 machine. Actual patient temperature is constantly being compared with the Set Point value, and MEDI-THERM automatically adjusts the blanket water temperature so that the desired patient temperature is achieved.

1) Inspect unit to insure that all Start-Up Procedures have been properly completed, and that the On-Off switch is ON.

2) Insert the sensing end of the Patient Probe into the patient, and tape securely to prevent accidental dislodgement.

3) Insert machine plug end of the Patient Probe into the PATIENT PROBE jack on the unit. (See Note 1).

4) Adjust the Temperature Control Switch until it indicates the desired patient temperature in °C.

5) Press AUTO CONTROL switch on control panel. AUTO CONTROL and AUTOMATIC PATIENT TEMP indicators will illuminate. Both Blanket Water and Patient Temperatures will be digitally displayed.

6) Blanket and patient temperature and skin condition should be checked every 20 minutes, or as directed by the physician.

   NOTE: The patient's temperature display will flash when patient's temperature is more than 1°C from the selected Set Point Temperature. This functions *only* in the AUTOMATIC CONTROL mode.

Should the Patient Probe become dislodged from the patient, the CHECK PATIENT PROBE alarm will sound. By pressing the PATIENT PROBE ALARM SILENCER switch, the alarm can be silenced for five (5) minutes while the cause is identified and corrected.

NOTES:
1) The CHECK PATIENT PROBE alert may sound if the unit is placed in AUTOMATIC CONTROL mode before the Patient Probe has been inserted in the patient, since the Probe will be sensing room temperature.
2) To prevent accidental triggering of the CHECK PATIENT PROBE alert, place probe in patient, and wait five (5) minutes before pressing AUTO CONTROL switch.
3) The CHECK PATIENT PROBE alert, with audible alarm, also functions when a probe is used in the Manual and PATIENT TEMP. NO THERAPY modes.

PATIENT TEMPERATURE MONITORING

(Refer to Number 3 (Backside) Instruction Card)

When operating the MTA-4700 in the PATIENT TEMP. NO THERAPY mode, the unit will monitor and display only the patient's temperature. No therapy is provided to the patient while operating in this mode.

1) Inspect unit to insure that all Start-Up Procedures have been properly completed, and that the On-Off Switch is ON.
2) Insert the sensing end of the Patient Probe into the patient, and tape securely to prevent accidental dislodgement.
3) Insert machine plug end of Patient Probe into the PATIENT PROBE jack on the unit.
4) Press the PATIENT TEMP NO THERAPY switch located on the control panel. The PATIENT TEMP NO THERAPY indicator will be illuminated, and the patient's temperature will be displayed.

PATIENT SAFETY (And Other Precautions)

The following precautions and procedures should be carefully reviewed prior to each application.

PATIENT PRECAUTIONS

1) **BLANKET TEMPERATURE EFFECTS**

OPERATING ROOM PATIENTS - Patients with poor circulation associated with inadequate heart function, reduction in blood volume, and constriction of peripheral blood vessels may deviate from the normal response to the external application of heat and cold.

TEMPERATURE SENSITIVE PATIENTS - Patients with impaired peripheral blood circulation caused by vascular diseases and patients who are incapacitated may be more sensitive to temperature changes than patients with more normal circulation.

PEDIATRICS - The core temperatures of infants and children are more responsive to surface heating and cooling than adults. The smaller the patient, the more pronounced the effect because of their higher ratio of skin contact area to body volume.

THE BLANKET/PAD TEMPERATURE SHOULD BE SET ONLY AS PRESCRIBED BY AND UNDER THE GUIDANCE OF A PHYSICIAN. CHECK PATIENT, INCLUDING PATIENT'S CORE TEMPERATURE, SKIN CONDITION IN AN AREA IN CONTACT WITH THE BLANKET AND THE BLANKET(S) WATER TEMPERATURE EVERY 20 MINUTES OR AS DIRECTED BY THE PHYSICIAN. CHECK PEDIATRIC, TEMPERATURE SENSITIVE, AND OPERATING ROOM PATIENTS MORE FREQUENTLY.

2) **ADDITIONAL HEAT SOURCES**

Heat applied by the blanket can result in a rise in skin temperature at the areas of contact. The additional heat rise due to electrosurgical currents flowing to the dispersive electrode could be sufficient to cause tissue injury. Each thermal effect by itself may be completely safe, but the additive effect may be injurious (1). KEEP ADDITIONAL HEAT SOURCES FROM BETWEEN THE PATIENT AND THE BLANKET.

3) **LOCALIZED SKIN INJURY**

Localized skin injury due to tissue compressed between boney prominences and fluid-filled channels has occured during prolonged cardiovascular procedures at blanket temperatures well below the scientifically established epidermal burn injury threshold (2, 3, 4, 5, 6).

Local ischemia can follow the application of pressures exceeding mean capillary pressure resulting in tissue necrosis. This local effect may be enhanced by generalized impairment of the circulation, local shearing forces and increased metabolic demand because of temperature elevation. Pathological changes may begin in two (2) hours.

PREVENT EXCESSIVE AND/OR PROLONGED TISSUE PRESSURE AND SHEARING FORCES - ESPECIALLY OVER BONEY PROMINENCES.

4) **PATIENT CORE TEMPERATURE**

If the patient's core temperature is not responding and/or does not reach the prescribed temperature in the prescribed time and/or deviates from the prescribed temperature range, the attending physician should be notified. MONITOR THE PATIENT'S CORE TEMPERATURE FREQUENTLY.

5) **BLANKET COVERING**
A dry cotton sheet placed between the patient and the Thermia Blanket will provide a sanitary barrier and absorb perspiration. It will also promote more uniform distribution of heat and reduce localized tissue pressure. PLACE A DRY COTTON SHEET BETWEEN THE PATIENT AND THE BLANKET WHEN USING ALL-VINYL BLANKETS. Vinyl blankets with non-woven fabrics surfaces do not require a cotton sheet.

6) **DRYNESS BETWEEN PATIENT AND BLANKET**
The application of heating or cooling may affect the toxicity of solutions. Prep solutions have been reported to injure the skin when allowed to remain between patients and water circulating heating blankets during prolonged procedures (8, 9). KEEP THE AREA BETWEEN THE PATIENT AND THE BLANKET DRY.

MACHINE PRECAUTIONS

1) **FILLING WATER SUPPLY**
The MTA-4700 should be filled only with distilled water; alcohol is NOT required. DO NOT operate the MTA-4700 without water as damage to internal components may result. DO NOT OVERFILL.

2) **AUDIBLE WARNING ALARM**
If the audible warning alarm sounds and the MACHINE SHUT-DOWN REMOVE FROM SERVICE alert is displayed, it means the unit has shut-down due to blanket water temperature exceeding either the high or the low limit thermostats. *Immediately* remove the unit from service.

3) **FLAMMABLE ANESTHETICS**
The MEDI-THERM unit must not be used in the presence of flammable anesthetics.

4) **CAUTION:** Power interruption will cause machine to go into a standby mode. (no therapy)

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CARE OF MEDI-THERM

As with any precision equipment, proper care and maintenance will insure proper performance and reliability. The following routine maintenance procedures will help insure dependable MEDI-THERM operation.

MACHINE CARE

- The MTA-4700 Control Panel and top surfaces can be cleaned with a soft cloth lightly dampened with isopropyl alcohol.
- Clean up any accidental spills immediately—use a cloth lightly dampened with isopropyl alcohol.
- When you are filling an empty unit, add a small amount of germicidal or sanitizer solution to the water. (MTA-33 4 oz. liquid, or equiv.). Carefully follow manufacturer's recommended concentration to prevent algae growth within the system and Thermia Blanket.

  DO NOT use too much concentrate, as it will result in "foaming" and reduce the Blanket efficiency.
- DO NOT use bleach.
- You may check for clarity of fluid by viewing water flowing through clear vinyl pad and/or hosing.

BLANKET CARE

- Allow the Thermia Blanket(s) to remain connected to the MTA-4700 for about 10 minutes after the unit has been turned off. This will allow most of the water to drain back into the machine.
- Standard Thermia Blankets should be cleaned with a damp cloth and mild detergent. If blankets must be sterilized, use any *cold* sterilization means, except alcohol. Exposure to harsh chemicals will cause blankets to lose flexibility and reduce their resistance to cracking.
- If gas sterilization is necessary, sterilization temperature must not exceed 63°C (145°F). Thermia Blankets *should not be* sterilized in an autoclave.

  When storing Standard Blankets, they should be rolled loosely. (Do not allow to freeze). Single Patient Use Blankets should be discarded after use.

  Standard Thermia Blankets can often be repaired using a vinyl patch kit. Do not return Blankets to factory for repair.

PROBE CARE

DO NOT AUTOCLAVE REUSABLE PROBES MAY BE CLEANED WITH A DAMP CLOTH AND MILD DETERGENT. WIPE DRY. DISPOSABLE PROBES SHOULD BE DISCARDED AFTER USE.

- If probe must be sterilized use any cold sterilization means except alcohol. Always wipe dry. If Gas Sterilization is necessary, probes are made of PVC and should be handled like any other PVC Product.
- Gas sterilization temperature must not exceed 63°C. (145°F).
- Exposure to harsh chemicals will cause probe to lose flexibility and resistance to cracking.

PROBE CHECK WELL CARE

The Probe Check Well should be cleaned with a small tubular brush and detergent, and then wiped with a commercial disinfectant.

QUICK DISCONNECTS

If the MTA-4700 is not used regularly, the metal Quick Disconnect fittings may become stiff and difficult to engage. This problem can be eliminated by applying a silicone-base or light machine oil to the inside of the machine fitting and the outside of the Blanket connector.

DRAINING UNIT

It is not necessary to drain the MTA-4700 after each use. However, periodic draining (at least once a month) is recommended.

To lower the water level, attach a connector hose to a "SUPPLY" Connector and direct flow into sink or pail. Press On-Off switch ON and press MANUAL CONTROL switch. The unit will pump the water reservoir dry. Press On-Off switch to OFF when CHECK WATER FLOW light illuminates.

Complete preventive maintenance and service procedures are outlined in the MEDI-THERM Service Instruction Manual. These procedures should be performed only by qualified technical personnel.

ALERTS/TROUBLESHOOTING

Because of its reliability, most MEDI-THERM operating problems are minor, and can be corrected by the operator. The following are troubleshooting hints. More serious problems or repairs should be made in accordance with the Service Instruction Manual. This work should only be performed by a qualified bio-medical technician, familiar with repair practices for servicing medical devices.

ALERTS

The MEDI-THERM has both visual and audible Alert Indicators to assist you in identifying machine or operator caused problems. An explanation of these signals and their probable causes follow.

CHECK WATER FLOW

Circulation of water through the blanket(s) has been restricted. Air bubbles in the blanket may remain stationary although water is flowing; a few bubbles do not adversely affect operation of the blanket.

- IMPORTANT: Locate and correct source of low flow problem as quickly as possible. Continued operation with CHECK WATER FLOW light on may cause the machine to shut down. See MACHINE SHUT DOWN REMOVE FROM SERVICE alert, next page.
- Check that blanket hoses are connected correctly. One hose of blanket should be connected to a RETURN connector and one hose to a SUPPLY connector.
- Check that hoses are fully inserted and seated into the connectors on the unit. (See ATTACH BLANKET in Start-Up Procedure).
- Check that all hose clamps (4) are fully open.
- Check that hoses are not kinked or pinched off. Make sure blanket is flat and not creased. If a blanket is used with patient in sitting position, flow may be pinched off.
- Confirm that water supply is at proper level.
- Disconnect blanket from connector hose. Direct connector hoses into water fill opening and start unit. If there is still no flow, turn machine OFF, and remove from service.

CHECK PATIENT TEMP SETTING

This alert indicates that the Temperature Control Switch has been set to a temperature which is not within the normal range (25°C to 41°C) for patient control.

- Check Temperature Setting, and adjust to a value which is within the normal range.

NOTE: If CHECK PATIENT TEMP SETTING light comes on (in the AUTOMATIC CONTROL mode only), therapy will stop. Status lights will go out and no additional Heating or Cooling will occur until the correct setting is entered.

CHECK PATIENT PROBE

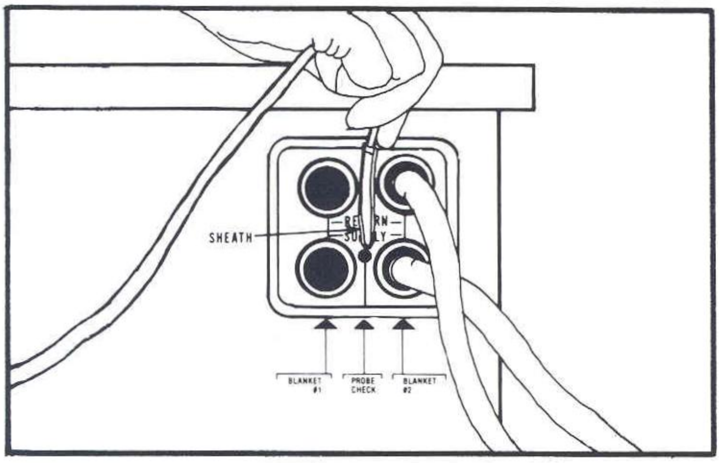
Indicates that Patient Probe is sensing below 25°C or above 45°C, and is not a normal patient temperature.

- Check probe to make sure it has not become dislodged from patient. Re-insert and tape securely if required.

Perform probe check by inserting probe into sterile sheath and then into probe check well on blanket manifold. Operate unit in MANUAL CONTROL mode with a blanket connected. Set Temperature Control Switch between 33°C & 37°C. Wait until unit stabilizes (IN-TEMP ZONE). Digital temperature displays should read within 2°C of each other. If not, probe may be defective or incorrect probe is being used.

If probe appears defective, try another probe. If new, correct probe does not meet this test, unit may be out of calibration. Use only YSI 400 Series probes or equivalent.

CAUTION: Use protective sheath (cover) on probe to prevent cross-contamination.



- CHECK PATIENT PROBE alert may sound if unit is placed in AUTOMATIC CONTROL mode before patient probe has been inserted in patient, since probe will be sensing room temperature. Place probe in patient and wait five (5) minutes before pressing AUTO CONTROL switch.
- CHECK PATIENT PROBE audible alarm can be silenced for five minutes while diagnosing problem by pressing PATIENT PROBE ALARM SILENCER, See Figure (2).
- If CHECK PATIENT PROBE light comes on (in AUTOMATIC CONTROL mode only), therapy will stop, status lights will go out and no additional heating or cooling will occur until the problem is corrected.

MACHINE SHUT-DOWN REMOVE FROM SERVICE

This alert indicates that the unit has gone into shutdown. Unit should be removed from service immediately, and Bio-Medical Engineering notified for service.

TROUBLESHOOTING

SYMPTOM A: BLANKET(S) WILL NOT HEAT.

- Check that water is circulating through the blanket(s). If there is no circulation, blanket temperature *will not rise* and CHECK WATER FLOW alert should be on. If ON, see CHECK WATER FLOW alert section for corrective measures. DO NOT FOLD BLANKETS.
- Check that Temperature Control is operating by adjusting the Temperature Control Switch 10°C above and below the indicated blanket temperature. This should cause the HEAT and COOL indicator lights to alternately illuminate.

SYMPTOM B: BLANKET(S) WILL NOT COOL.

- Check to see if water is circulating through the blanket(s). If there is no circulation the blanket temperature *will not cool* and CHECK WATER FLOW alert should be on. If ON, see CHECK WATER FLOW alert section for corrective measures.
- Confirm that the water supply is at the proper level (filled just to the screen).
- Check that rear and side air vents are not blocked. Inlet and exhaust grills should be kept clear and clean to allow air to circulate freely.
- Check that Temperature Control is operating by adjusting the Temperature Control Switch 10°C above and below the indicated blanket temperature. This should cause the HEAT and COOL indicator lights to alternately illuminate.

SYMPTOM C: UNIT WILL NOT TURN ON.

- Reset On-Off switch (Circuit Breaker). If Circuit Breaker trips again, remove machine from service and notify Bio-Medical Engineering.

SYMPTON D: ON/OFF SWITCH IS TURNED ON, BUT CONTROL PANEL IS DARK AND NO OPERATING NOISE IS COMING FROM MACHINE.

- This could be a normal condition. Press mode switch (MANUAL CONTROL or AUTO CONTROL) and if water begins to flow, machine is working properly.
- If water does not flow with ON/OFF switch ON and mode either in MANUAL CONTROL or AUTO CONTROL, remove from service and notify Bio-Medical Engineering.

BLANKETS/ACCESSORIES

Adult and pediatric size blankets are available in all-plastic or plastic with non-woven fabric surfaces.

SINGLE PATIENT USE BLANKETS, ALL PLASTIC

DHP-901	Adult General Use
DHP-902	Pediatric General Use

SINGLE PATIENT USE BLANKETS, PLASTIC w/NON-WOVEN FABRIC

DHP-911	Adult General Use
DHP-912	Pediatric General Use

SINGLE PATIENT USE BLANKETS, PLASTIC w/NON-WOVEN FABRIC

DHP-810	O.R. Table and General Use
DHP-812	Pediatric General Use
DHP-813	Adult General Use

REUSABLE BLANKETS, ALL PLASTIC

HP-7010	Adult General Use
HP-7020	Pediatric General Use

REUSABLE BLANKETS (Covered)

HP-7310	Adult General Use

All blankets require reusable DBK connector hoses.

ACCESSORIES

DBK-5 -8 foot connector hose for use with Gaymar and and American Medical Systems machines
DBK-6C -8 foot connector hose for use with Cincinnati Sub-Zero machines
HBX-8 -8 foot Hose Extension
PAT-101 -Adult Reusable Probe
PAT-102 -Pediatric Reusable Probe
DP-400 -Disposable Probe (Adult and Pediatric)
ADP-10 -Reusable Probe Adaptor (Gaymar and Cincinnati Sub-Zero)
ADP-10A -Reusable Probe Adaptor (American Medical Systems)
MTA-33 -Germicide/Algicide, pint
XFMR-1 -Transformer
RC-1 -Reusable Container

WARRANTY/TRAINING/ARRIVAL

WARRANTY

The Gaymar Model MTA-4700 is warranted against defects in materials and workmanship for a period of one year from date of manufacture. Refrigeration System compressor is warranted for an additional four (4) years on a prorated basis.

CUSTOMER TRAINING

"In Service" training is recommended and can be arranged through your Gaymar Representative. Comprehensive Repair and Maintenance is also available through Gaymar Technical Service.

ARRIVAL/INSPECTION

Refer to MEDI-THERM Service Manual, Section 3.1 for Arrival and Inspection instructions, and initial check-out procedures.

PERSONAL NOTES & REMINDERS

The °F to °C Conversion Scale is provided for your convenience.

CELSIUS—FAHRENHEIT CONVERSION TABLE

°C	°F
0	32
.5	32.9
1	33.8
1.5	34.7
2	35.6
2.5	36.5
3	37.4
3.5	38.3
4	39.2
4.5	40.1
5	41
5.5	41.9
6	42.8
6.5	43.7
7	44.6
7.5	45.5
8	46.4
8.5	47.3
9	48.2
9.5	49.1
10	50
10.5	50.9
11	51.8
11.5	52.7
12	53.6
12.5	54.5
13	55.4
13.5	56.3
14	57.2
14.5	58.1
15	59
15.5	59.9
16	60.8
16.5	61.7
17	62.6
17.5	63.5
18	64.4
18.5	65.3
19	66.2
19.5	67.1
20	68
20.5	68.9
21	69.8
21.5	70.7
22	71.6
22.5	72.5
23	73.4
23.5	74.3
24	75.2
24.5	76.1
25	77.0
25.5	77.9
26	78.8
26.5	79.7
27	80.6
27.5	81.5
28	82.4
28.5	83.3
29	84.2
29.5	85.1
30	86
30.5	86.9
31	87.8
31.5	88.7
32	89.6
32.5	90.5
33	91.4
33.5	92.3
34	93.2
34.5	94.1
35	95
35.5	95.9
36	96.8
36.5	97.7
37	98.6
37.5	99.5
38	100.4
38.5	101.3
39	102.2
39.5	103.1
40	104
40.5	104.9
41	105.8
41.5	106.7
42	107.6
42.5	108.5
43	109.4
43.5	110.3
44	111.2
44.5	112.1
45	113